MINES AND MINERAL DEPOSITS (EXCEPT FUELS) CASCADE COUNTY, MONT.

BY ALMON F. ROBERTSON

* * * * * * * * * **Information Circular 7589**

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Almon F. Robertson[1]

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INTRODUCTION AND SUMMARY

This is one of a series of reports describing investigations within the Missouri River Basin in Montana conducted by mining engineers of the Bureau of Mines, Minerals Division, Region II. The primary purpose of these investigations is to provide basic information to agencies of the Department of Interior and others concerned with the planning of power and other water developments in the basin. This report contains only such factual data as have been authorized for public distribution. Special precautions have been taken not to reveal any information or data that are considered confidential.

The field investigations for this report were made during the summer of 1949. Virtually all known metallic mineral deposits in the county and some nonmetallic (industrial) mineral deposits were investigated. Most of the mines and prospects have been inactive for many years. The old underground workings generally are only partly accessible; many are entirely inaccessible. Most of the mining claims were located many years ago, and a considerable number were patented. Many claims were abandoned; others were relocated. Names and ownerships often have changed. Because of such conditions, much of the information on most of the mines and prospects necessarily has been obtained from available Federal and State publications, private geologists' and engineers' reports, and from owners and local residents.

Metal mining in Cascade County, Mont., has been confined mainly to the silver-lead-zinc deposits in the Montana (Neihart) and Barker districts in the southeastern part of the county. The Neihart district has yielded by far the greater part of the county's metal output. The mines generally have been operated intermittently, largely because of fluctuating or low silver and base metal prices.

Cascade County was organized in 1887. Search for gold placers led to the discovery in 1879 of rich silver-lead deposits in the Barker-Hughesville area. In 1881, the first silver-lead ore discoveries were made in the area around Neihart.

The mines in the Barker and Neihart areas were developed rapidly. Only high-grade silver ores could be mined profitably at that time. The ores had to be transported by pack train or horse or oxen-drawn wagons to Fort Benton, and from there were carried on Missouri River steamboats to Kansas City, St. Louis, and elsewhere for ocean shipment to Swansea, Wales, for smelting. Smelters soon were erected at Hughesville and Barker (Clendenin), but much of the high-grade ore and bullion produced during 1883 and 1884 was shipped by river to Omaha. Great Falls, Mont., was founded in 1882. Concentrating mills and smelters soon were erected at various localities. A branch line of the Great Northern Railroad reached Barker and Neihart in 1891. Mining generally was suspended during the years of low silver prices.

From 1889 to 1948, inclusive, the mines in Cascade County produced gold, silver, copper, lead, and zinc valued at $20,093,595 in terms of recovered metals. Records are not available for the years prior to 1889, but production is known to have had considerable value. Gypsum was mined and processed in the county from 1908 to 1915. Some limestone was mined years ago for smelter flux and for use in a sugar factory. Fire clay is being mined near Armington.

ACKNOWLEDGMENTS

Statistical information on mineral production was supplied by the Economics and Statistics Division, Bureau of Mines, Salt Lake City, Utah. Climatological data were supplied by the U. S. Weather Bureau, Helena, Mont.

Information regarding smelter schedules, power schedules, and freight rates, as related to the mineral industry within Cascade County, was provided by the Anaconda Copper Mining Co., the American Smelting and Refining Co., the Montana Power Co., the Chicago, Milwaukee, St. Paul, & Pacific Railroad, and the Great Northern Railroad.

Special acknowledgment is given the many claim owners and prospectors for their kind cooperation during the field investigations and for providing information and maps of various areas and properties.

Much valuable information was obtained from reports and publications of the U. S. Geological Survey, the U. S. Bureau of Mines, the Montana Bureau of Mines and Geology, the State of Montana, and other sources. Acknowledgment of the source of such information is noted in the text either directly or by a number in parentheses that refers to the list of references at the end of this report.

LOCATION AND ACCESSIBILITY

Cascade County is in north-central Montana. The area of the county is 3,411 square miles. It is situated geographically between the 111th and 112th meridians, west longitude, and between the 47th and 48th parallels, north latitude. Population, according to the 1940 census, was 41,999. At that time Great Falls, the county seat, had a population of 29,928 within the corporate limits, or 33,332 including suburban inhabitants. Based upon the Polk Directory returns of 1949, the population of Great Falls and its environs was estimated to be 43,666. Great Falls is on the Missouri River in the north-central part of the county; it is the principal supply center and the site of the Anaconda Copper Mining Co.'s Great Falls reduction works and zinc plant. Metal mining has been confined mainly to the mountainous area in the southeastern part of the county (fig. 1).

The Great Northern Railroad and the Chicago, Milwaukee, St. Paul, & Pacific Railroad serve the county. Branch lines of the Great Northern Railroad extend to Great Falls from Shelby, 99 miles to the north, and from

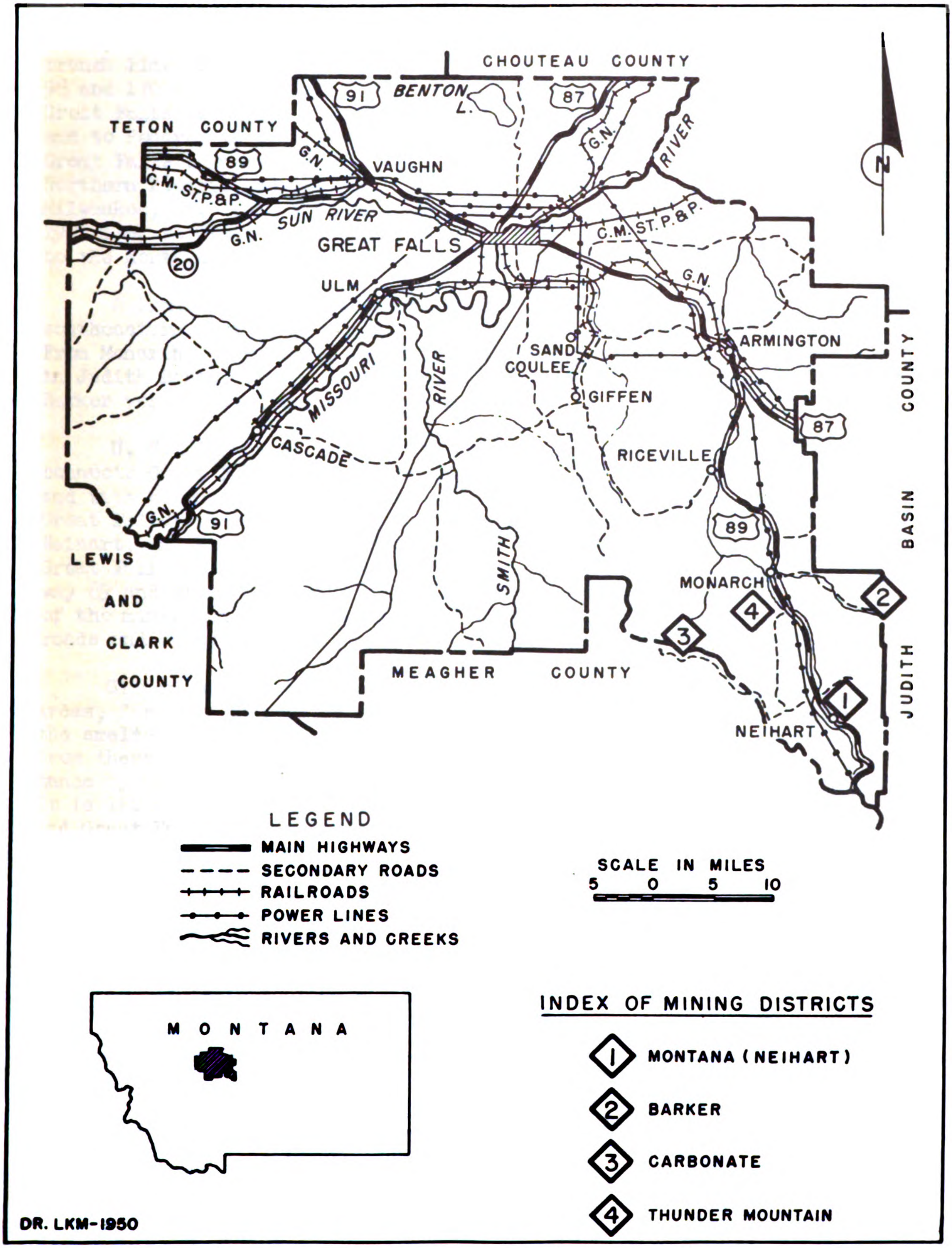


Figure 1. - Index map, Cascade County, Mont.

Havre, 123 miles to the northeast, both points being on the main line. A branch line from Great Falls connects with Helena and Butte, respectively 98 and 170 miles distant to the southwest. Other branch lines extend from Great Falls to August a in Lewis and Clark County, 54 miles to the west, and to Pendroy in Teton County, 77 miles to the northwest. A branch from Great Falls connects at Billings, 235 miles to the southeast, with the Northern Pacific and Chicago, Burlington, & Quincy Railroads. The Chicago, Milwaukee, St. Paul, & Pacific Railroad branch line from Harlowton extends 199 miles to Great Falls and on to Agawam in Teton County, 66 miles farther to the northwest; it crosses the northern part of Cascade County.

A branch of the Great Northern Railroad formerly was operated in the southeastern part of the county from Armington, through Monarch, to Neihart. From Monarch, a privately owned spur track served the Barker mining district in Judith Basin County. This branch line and the spur from Monarch to Barker were removed during World War II.

U. S. Highway 91 crosses the county in a north-south direction; it connects Great Falls with Shelby and the province of Alberta to the north and with Helena and Butte to the southwest. U. S. Highway 89 passes through Great Falls; it leads northwest to Glacier Park and southeast to Armington, Neihart, and White Sulphur Springs. U. S. Highway 87 extends east from Great Falls to Lewistown, thence south to Roundup and Billings. U. S. Highway 89 and graveled county roads leading therefrom provide access to most of the mines and prospects in the vicinity of Barker and Neihart. Unimproved roads and Forest Service trails lead to the more isolated properties.

Silver-lead ores and concentrates produced in the Neihart and Barker areas, formerly shipped by rail to the smelters, now are trucked directly to the smelter at East Helena. Zinc concentrates are trucked to Armington and from there are shipped by rail to the zinc plant at Great Falls. The distance by road and highway from Barker and Neihart to Armington is 36 miles. It is 160 miles from Neihart to the Smelter at East Helena via Armington and Great Falls. From Neihart by U. S. Highway 89 to White Sulphur Springs, State Highway 6 to Townsend, and U. S. Highway 10 N. to East Helena the distance is 118 miles. The distance from Barker by this route is 144 miles. Although this route is shorter, it is used infrequently because of the steep grades on King's Hill south of Neihart.

Distance in miles by railroad from Armington to the smelting and refining plants in Montana via the Great Northern Railroad are as follows:

Shipping point	American Smelting & Refining Co., East Helena	Anaconda Copper Mining Co., Washoe Sampler, Butte	Anaconda Copper Mining Co. zinc plant, Great Falls
Armington	132	199	31

The location of the principal mining districts and their relation to highways, railroads, and population centers are shown on figure 1.

CLIMATE

The climate in Cascade County varies markedly at different localities during all seasons of the year. It generally is semiarid. Summer temperatures usually are moderate. In July and August temperatures may exceed 100° in the Missouri River Valley. During the same months temperatures in the Little Belt Mountains may range from below freezing to 90°. Heavy snowstorms may occur in the mountains, whereas at lower altitudes fine warm weather may prevail. The winters are long and severe; though tempered for short periods by warm chinook winds, temperatures may range from above freezing to more than 40° below zero.

Precipitation varies considerably in different parts of the county. Severe thunderstorms are common in the mountains during the summer. Maximum precipitation usually occurs during May and June and minimum during December and January. Climatological data recorded at stations in and adjacent to Cascade County, Mont., are given in tables 1 and 2. They were compiled from data provided by the U. S. Weather Bureau, Helena, Mont.

TABLE 1. - Average monthly and annual precipitation[1] and snowfall, in inches, at following U. S. Weather Bureau Stations in Cascade County, Mont.

Station............. Elevation, feet....	Adel 5,200		Great Falls (airport)[2] 3,657		Kings Hill 7,450	
	Precipitation[1]	Snowfall	Precipitation[1]	Snowfall	Precipitation[1]	Snowfall
Length of record, years.....	47	31	54	37	8	8
January............	1.30	15.0	0.61	8.8	1.98	31.4
February...........	1.32	14.9	.57	6.5	2.27	42.5
March..............	1.84	19.2	.86	7.7	1.93	31.8
April..............	2.38	15.5	1.15	4.4	2.09	24.8
May................	3.77	7.7	2.24	.9	3.11	9.0
June...............	4.24	0.6	3.13	.T	4.56	8.6
July...............	2.06	.0	1.51	.0	1.94	0.0-0.2
August.............	1.84	.1	1.15	.T	1.97	0.0-0.2
September..........	2.43	4.3	1.44	.8	2.11	9.4
October............	2.01	16.0	.86	2.2	1.98	18.2
November...........	1.14	11.6	.68	6.7	2.21	35.6
December...........	1.35	16.1	.65	7.3	2.40	39.1
Annual average...	25.68	121.0	14.85	45.3	28.55	250.8

[1] Includes snowfall converted to water.

[2] Four miles southwest of Great Falls.

TABLE 2. - Average temperature data, in degrees Fahrenheit, at following U. S. Weather Bureau Stations in Cascade County, Mont.

Station	Adel	Great Falls	Kings Hill
Elevation, feet	5,200	3,657	7,450
Length of reocrd, years	31	39	7
Annual average	40.3	45.4	35.4
Mean maximum:			
January	32.0	33.3	26.0
July	76.4	83.7	71.8
Annual	53.6	57.6	46.9
Mean minimum:			
January	9.6	12.4	9.4
July	44.7	53.7	43.2
Annual	27.0	33.3	24.4
Highest:			
January	58.0	86.0	-
July	97.0	103.0	-
Annual	98.0	106.0	90.0
Lowest:			
January	-45.0	-44.0	-
July	25.0	35.0	-
Annual	-51.0	-44.0	-42.0
Latest date 32° or lower in spring	May 27 to July 12[1]	April 9 to June 8	June 8 to June 23 [1]
Earliest date 32° or lower in fall	July 17 to September 21[1]	September 6 to October 14	August 17 to October 6[1]

[1] Below freezing temperature recorded in all months during some years.

TOPOGRAPHY

The northern part of Cascade County is characterized by wide, gently sloping benches that extend northward from the Missouri River. At the west, the foothills of the main range of the Rocky Mountains extend in irregular spurs toward the plains. Along the east boundary the Highwood Mountains rise abruptly above the rolling benches, which slope northward toward the Missouri River from the Little Belt Mountains. The southeastern part of the county includes a part of a jumbled mass of mountains that extend northward from the main Little Belt Mountain Range. The southern boundary of the county follows the crest of the Little Belt Mountains in a northwesterly direction. Steep ridges extending northeastward from the Big Belt Mountains and the rolling hills and gently sloping benches west of the junction of Smith River with the Missouri River form the southwestern part of the country.

Altitudes range from 2,800 feet above sea level at the Missouri River between Cascade and Chouteau Counties to a maximum of 8,473 feet on Long Baldy Mountain east of Neihart. The average altitude is between 3,000 and 4,000 feet.

The Highwood Mountains northeast of Armington cover an area of about 80 square miles. They have been deeply eroded, but the peaks and ridges are rounded. Slopes generally are gradual. Highwood Peak, the highest in the range, has an altitude of 7,600 feet, or about 3,300 feet higher than the surrounding plain. This peak and most of the others in this mountain mass are in Chouteau and Judith Basin Counties, which adjoin Cascade County on the northeast and east.

The Little Belt Mountains at the southern border of the county extend in a northwest-southeast direction for about 45 miles, thence eastward for about 30 miles. The northwestern part of the range averages about 25 miles in width. The eastern part narrows to a point near Judith Gap in Wheatland County. North of the divide, the range contains a number of isolated mountains that rise above their surrounding areas. Several of these mountains exceed 8,000 feet in altitude. The ridges are rounded, but deep canyons have been eroded by numerous streams. Many of these spring-fed streams have a continuous year-round flow; others are intermittent as their waters disappear in the sediments and surface debris near the base of the mountains.

The Missouri River flows northeastward across the central part of Cascade County. The southern and eastern parts of the county are drained by northward-flowing steams; the western and northern parts by the eastward flowing Sun River and its tributaries and by smaller streams that flow southward toward the Missouri River.

The northern slopes of the mountains above 6,000 feet in altitude generally are heavily timered. Most of the forest is second growth, but in the more remote localities larger timber suitable for mining purposes can be found.

The wide valleys and gently sloping benches in the central and northern parts of the county are very fertile. Stock raising and farming are the principal industries. Near Great Falls the Missouri River has cut a deep channel through the surface soils and gravels of the valley and into the underlying sedimentary formations. In this locality the river has a fall of 365 feet in a distance of about 8 miles. Utilization of the energy of these falling waters by the construction of dams and power houses has provided electric energy for many industries in the county and western Montana.

HISTORY

Cascade County is reported to have been visited by white men about 1744, when de La Verendrye, a French explorer, turned south from Canada, crossed into what is now North Dakota, and followed up the Missouri River to near what is now Great Falls, Mont. (16). In June 1805, Lewis and Clark followed the Missouri River on their journey across the northwest to the Pacific coast. In the following years the region was visited frequently by many adventurers, fur trappers, and explorers, who followed the river to the head of navigation below the Great Falls. In 1846 a trading post was established at Fort Benton by Captain John Mullan. Travel through the region increased with the influx of settlers, expecially after the discovery of gold at Virginia City, Bannock, Last Chance Gulch, Confederate Gulch, and other localities in Montana (16) (11).

Gold placers were discovered about 1863 in Yogo Gulch at the eastern end of the Little Belt Mountains, an area later included in Judith Basin County, but the prospectors were driven out by hostile Indians. About 1879 the placers at Yogo Gulch were "rediscovered." They did not prove to be profitable, however, and by 1880 most of the claims were abandoned. (28).

The silver-lead deposits near Barker, now mainly in Judith Basin County, were discovered in October 1879 by Buck Barker and Pat Hughes (13) who had left Yogo Gulch in search of placer deposits. The first claims in the Neihart area were located by J. L. Neihart, J. C. O'Brien, James Anderson, S. R. Hartley, and Michael Powers during the summer of 1881. (13).

Mines in the Neihart and Barker areas were developed rapidly, and much ore was produced during the next few years. Only the high-grade ore could be mined at a profit. It had to be transported to Fort Benton by pack animals or by wagons drawn by horses or oxen and then shipped by river steamers to Kansas City, St, Louis, or New Orleans; from there it was sent to Swansea, Wales, for smelting. To avoid these high transportation costs, smelters were constructed at Hughesville and at Barker, which at that time was called Clendennin. The smelter at Hughesville did not operate long because it was not equipped with satisfactory refractory lining. The smelter at Clendennin, built by Colonel George Clendennin in 1881, had a 40-ton water-jacketed furnace. It was operated until 1883 and produced bullion valued at $375,000 (9). Some of the high-grade ore and bullion produced during 1883 and 1884 was shipped via the Missouri River to Omaha for smelting. Some of these ore shipments are reported to have netted the mine owners $200 a ton after deducting $100 a ton for freight and treatment charges (29).

Great Falls was founded in 1882 by Paris Gibson with the assistance of James J. Hill and others. A smelter was constructed near Giant Springs below Great Falls by the United Smelting & Refining Co. This smelter was operated for several years and treated many thousand tons of silver-lead ore from the Neihart and Barker areas. During the 1880's, some ore was hauled to other smelters at Wickes, Toston, and Argenta, Mont.

The Hudson Mining Co. constructed a concentrator and smelter at Neihart in 1885-86. About 1,000 tons of concentrates and bullion valued at $50,000 to $60,000 were produced before the company ceased operating in 1887 (29). From 1887 to 1891 little mining was done at Neihart or Barker. In 1888 two new smelters had been constructed in Montana. One of these was built near Great Falls under auspices of the Saint Paul, Indianapolis, and Manitoba Railway; the other was built at Helena by the Helena & Livingston Co. under the auspices of the Northern Pacific Railroad (22-1887). Completion of the branch line of the Great Northern Railroad to Neihart in 1891 provided transportation to the new smelters at reasonable rates. Mining increased in the Neihart and Barker areas (17). Several properties were developed and became steady producers.

The population of Neihart in 1892 was estimated at 2,500. Demonitization of silver in that year caused the price of silver to drop from about $1 to about $0.64 an ounce. The price of lead also was low. Mining declined; from 1895 to 1905 only a few of the exceptionally high-grade mines could be operated profitably. Between 1905 and 1915 operation at most of the mines was intermittent. Two small concentrators were built during this time, but as only a bulk concentrate high in zinc was produced, there was little if any advantage over direct shipment of sorted ore to the smelters. A small cyanide plant was constructed at one of the mines on Snow Creek. This plant was operated for only a short time; only one small bar of silver bullion was produced. In 1915 the price of silver began to rise. Steady base metal prices and the development of the selective flotation process for the concentration of low-grade ores created new interest in the Neihart and Barker areas. Many of the old mines were reopened; several of the larger mines expanded their operations; several selective flotation plants ere constructed. Having reached a peak in 1919, silver prices again declined. A few of the larger mines, however, continued to operate at a high rate of production. This was possible because the revenue received for lead, copper, and zinc concentrates compensated to some extent for the smaller returns for silver. Most of rich near-surface silver ores were depleted. Ore mined at greater depths contained less silver and more zinc. In 1930 the price of silver declined to less than 30 cents an ounce, and soon all of the mines were forced to close. Until 1935, most of the mines in the Neihart and Barker areas were inactive.

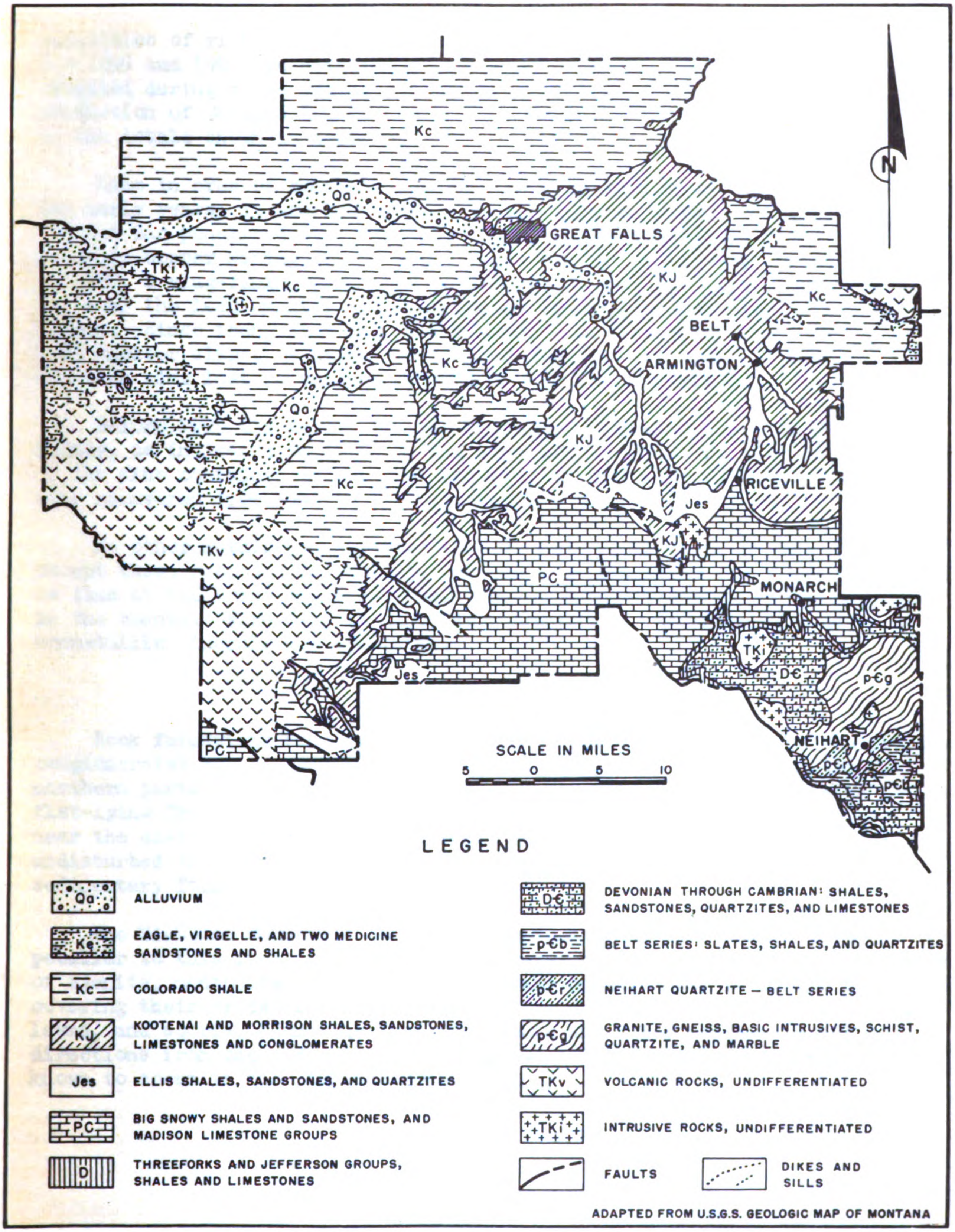
In 1934 the price of silver was established at 64.8 + cents per fine ounce. The price was raised to 71.875 cents in 1935. The increased price revived interest in the old mines, and many were reopened. During World War II and until 1949, prices of silver, lead, and zinc held at comparatively high levels. The sudden drop in the prices of lead and zinc in the spring of 1949, together with higher mining costs, was responsible mainly for the complete shut-down of all mining and milling operations in these areas.

PRODUCTION

Table 3 shows a production of gold, wilver, copper, lead, and zinc in Cascade County from 1889 to 1948, inclusive, in terms of recovered metals valued at $20,093,595. The table is a compilation of data provided by the Economics and Statistics Division of the Bureau of Mines, Salt Lake City, Utah (14).

Before 1887, when Cascade County was formed from parts of Chouteau and Meagher Counties, the Montana (Neihart) and Barker mining districts were in Meagher County. Cascade County boundaries were again changed in 1920, when Judith Basin County was created. This placed most of the mining claims in the Barker mining district in Judith Basin County. A few of these claims, however, including several from which a considerable tonnage of lead-silver ore had been mined, remain in Cascade County.

Between 1880 or 1881 (when the ore deposits in the Barker and Neihart areas were discovered) and 1889, few production records were kept. During these years many mines in the two areas were mined intensively; large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NEIHART
p€r
p€b
PC
SCALE IN MILES
5 0 5 10
LEGEND
Qa ALLUVIUM
Ke EAGLE, VIRGELLE, AND TWO MEDICINE SANDSTONES AND SHALES
Kc COLORADO SHALE
KJ KOOTENAI AND MORRISON SHALES, SANDSTONES, LIMESTONES AND CONGLOMERATES
Jes ELLIS SHALES, SANDSTONES, AND QUARTZITES
PC BIG SNOWY SHALES AND SANDSTONES, AND MADISON LIMESTONE GROUPS
D THREEFORKS AND JEFFERSON GROUPS, SHALES AND LIMESTONES
D€ DEVONIAN THROUGH CAMBRIAN: SHALES, SANDSTONES, QUARTZITES, AND LIMESTONES
p€b BELT SERIES: SLATES, SHALES, AND QUARTZITES
p€r NEIHART QUARTZITE — BELT SERIES
p€g GRANITE, GNEISS, BASIC INTRUSIVES, SCHIST, QUARTZITE, AND MARBLE
TKv VOLCANIC ROCKS, UNDIFFERENTIATED
TKi INTRUSIVE ROCKS, UNDIFFERENTIATED
FAULTS
DIKES AND SILLS

ADAPTED FROM U.S.G.S. GEOLOGIC MAP OF MONTANA

Figure 2. - Generalized geologic map of Cascade County, Mont.

quantities of rich lead-silver ores were produced. No production records for 1899 and 1900 are available, though it is known a number of mines were operated during those years. It is apparent, therefore, that the total metal production of Cascade County has been considerably larger than that indicated by the totals shown in table 3.

Zinc in ores or concentrates was not recovered by the smelters during the early years; it was lost mainly in the smelter slags. It was not paid for but was penalized at a high rate. The electrolytic zinc plant of the Anaconda Copper Mining Co. at Great Falls was not constructed until 1916. In 1927, a slag-fuming plant was constructed by the Anaconda Copper Mining Co. near the lead smelter of the American Smelting & Refining Co. at East Helena. Since then, zinc has been recovered in this plant from the molten lead smelter slags. A large quantity of old slag has been treated also, and much zinc lost in earlier operations has been recovered.

Before 1925 the amount of zinc recovered from ores mined in Cascade County, as indicated in table 3, was very small. However, the total quantity of the zinc contained in the ores shipped, as indicated by the amount of zinc recovered from 1940 to 1948, inclusive, apparently was large.

No other metals are reported to have been produced in Cascade County except those recorded in table 3. At one time limestone was mined for use as flux at the Great Falls smelter. Gypsum formerly was mined and processed in the county. Fire clay is mined near Armington. No production data on nonmetallic minerals are available.

GEOLOGY-GENERAL

Rock formations ranging from Archean gneisses and schists to Pleistocene conglomerates are exposed in Cascade County (fig. 2). In the central and northern parts, the soil, gravels, and glacial till are underlain with nearly flat-lying Cretaceous sedimentary rocks. Around the Highwood Mountains, near the east side of the county, these sedimentary rocks were relatively undisturbed in attitude by the volcanoes that broke through these earlier sedimentary formations.

The Highwood Mountains consist of various rocks of volcanic origin peculiar to this locality. The central cores of these mountains are composed of syenite, monzonite, and shonkinite. Surrounding these rocks and in places covering their eroded surfaces are extensive deposits of basltic breccias, lavas, and scoria. Numerous basaltic sheets and dikes radiate in all directions from the old volcanoes (27). No metallic mineral deposits are known to occur in the Highwood Mountains.

TABLE 3. - Mine production of gold, silver, copper, lead, and zinc in Cascade County [1], Mont., 1889-1948, in terms of recovered metals

Year	Mines [2] producing	Ore sold or treated short tons	Gold		Silver		Copper		Lead		Zinc		Total value
			Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
1889	[3]	[3]	5,609.00	$115,948	603,931	$567,695	-	-	-	-	-	-	$683,643
1890	do	do	3.26	67	-	-	-	-	-	-	-	-	67
1891	-	-	-	-	-	-	-	-	-	-	-	-	-
1892	[3]	[3]	27.11	560	1	1	-	-	-	-	-	-	561
1893	do	do	33.03	683	2	2	-	-	-	-	-	-	685
1894	do	do	61.38	1,269	3	3	-	-	-	-	-	-	1,272
1895	do	do	34.91	722	9	12	-	-	-	-	-	-	734
1896	do	do	34.49	713	2	2	-	-	-	-	-	-	715
1897	do	do	490.05	10,130	385,845	498,870	-	-	1,338,836	$160,660	-	-	669,660
1898	do	do	1,008.56	20,849	430,398	556,474	-	-	3,729,158	462,416	-	-	1,039,739
1899-1900	do	do	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
1901	2	3,113	-	-	246,738	219,008	-	-	-	-	-	-	219,008
1902	6	4,281	681.00	13,620	487,793	238,777	-	-	695,781	23,916	-	-	276,313
1903	4	2,257	30.00	600	168,760	75,787	-	-	468,216	9,111	-	-	85,498
1904	4	2,271	6.25	129	204,574	117,059	-	-	718,308	30,952	-	-	148,140
1905	6	11,951	183.18	3,787	415,708	251,088	-	-	747,686	35,141	-	-	290,016
1906	14	8,393	324.46	6,707	294,556	197,352	360	$70	569,046	32,436	-	-	236,565
1907	17	3,897	575.95	11,906	197,124	130,102	-	-	355,720	18,853	-	-	160,861
1908	15	1,103	226.78	4,688	94,021	49,531	6,352	839	180,320	7,574	-	-	62,632
1909	9	1,956	93.96	1,942	101,117	52,581	540	70	109,589	4,712	-	-	59,305
1910	12	1,381	104.97	2,170	57,060	30,812	18,415	2,339	298,489	13,134	-	-	48,455
1911	10	2,962	134.19	2,774	99,825	52,907	5,314	664	861,613	38,773	-	-	95,118
1912	14	7,406	195.29	4,037	138,608	85,244	6,379	1,053	2,259,494	101,677	-	-	192,011
1913	16 [4]	13,600	262.82	5,433	292,266	176,529	3,717	576	3,179,501	139,898	4,501	$253	322,689
1914	12	7,292	441.71	9,131	144,473	79,894	3,621	482	1,583,041	61,739	1,870	95	151,341
1915	15 [4]	1,789	592.50	12,248	154,488	78,325	4,365	764	526,751	24,757	-	-	116,094
1916	17	2,005	316.02	6,533	98,651	64,912	3,916	963	635,169	43,827	19,106	2,560	118,795
1917	34	6,791	220.35	4,555	204,178	168,243	1,023	279	1,295,063	111,375	-	-	284,452
1918	22	4,615	363.97	7,524	246,523	246,523	-	-	1,100,085	78,106	-	-	332,153
1919	23	16,903	729.83	15,087	518,946	581,220	6,305	1,173	2,860,275	151,595	-	-	749,075
1920	25	22,535	839.06	17,345	510,832	556,807	6,474	1,191	3,127,148	250,172	-	-	825,515
1921	17	14,528	390.19	8,066	512,092	512,092	2,098	271	1,498,387	67,427	-	-	587,856
1922	17 [4]	19,713	367.41 [5]	7,613	586,967	586,967	56	8	1,550,876	85,298	-	-	679,886
1923	17	110,939	539.70	11,157	555,357	455,393	582,918	85,689	1,824,454	127,712	5,075	345	680,296
1924	10	163,444	772.45	15,968	637,816	427,337	1,186,694	155,457	2,481,751	198,540	8,264	537	797,839
1925	10	193,289	718.85	14,860	639,497	443,811	1,342,458	190,629	3,705,994	322,421	101,960	7,749	979,470
1926	13	251,891	484.70	10,020	809,937	505,401	1,717,705	240,479	5,057,551	404,604	656,881	49,266	1,209,770
1927	8	279,544	372.39	7,698	702,341	398,227	1,605,579	210,331	4,153,356	261,661	1,275,491	81,631	959,548
1928	8	199,945	356.00	7,359	512,440	299,777	768,971	110,732	2,863,135	166,062	766,826	46,776	630,706
1929	5	48,746	82.42	1,704	157,503	83,949	399,911	70,384	985,225	62,069	109,156	7,204	225,310
1930	1	355	7.80	161	8,920	3,434	19,090	2,482	147,255	7,363	4,022	193	13,633
1931	5	126	103.00	2,134	12,481	3,619	5,839	531	64,431	2,384	-	-	8,668
1932	4	59	65.00	1,343	6,330	1,785	1,825	115	15,767	473	-	-	3,716
1933	3	51	3.00	63	360	126	734	47	8,567	317	8,071	339	892
1934	8	665	25.00	886	14,720	9,516	450	36	40,919	1,514	-	-	11,952
1935	18	3,614	31.00	1,078	29,632	21,298	2,398	199	63,625	2,545	3,773	166	25,286
1936	9	64,856	441.00	15,428	139,858	108,320	1,185	109	219,326	10,089	-	-	133,946
1937	13	44,618	984.00	34,440	239,660	185,377	2,000	242	435,000	25,665	-	-	245,724
1938	9	37,033	1,197.00	41,895	305,893	197,749	3,786	371	424,065	19,507	-	-	259,522
1939	11	44,432	2,078.00	72,730	438,374	297,563	9,250	962	586,425	27,562	10,000	520	399,337
1940	14	74,594	3,569.00	124,915	730,959	519,793	22,000	2,486	1,910,700	95,535	1,425,000	89,775	832,504
1941	10	103,288	4,839.00	169,365	1,104,047	785,100	46,000	5,428	3,201,000	182,457	2,948,000	221,100	1,363,450
1942	11	77,208	2,765.00	96,775	730,620	519,552	32,000	3,872	2,067,000	138,489	1,018,700	94,739	853,427
1943	11 [4]	41,267	501.00	17,535	197,730	140,608	9,700	1,261	1,067,600	80,070	529,500	57,186	296,660
1944	7	48,274	384.00	13,440	93,915	66,784	18,800	2,538	1,223,800	97,904	1,699,500	193,743	374,409
1945	6	35,141	163.00	5,705	75,285	53,536	8,800	1,188	949,000	81,614	1,906,600	219,259	361,302
1946	6	22,226	129.00	4,515	122,286	98,807	7,000	1,134	743,000	80,987	918,500	112,057	297,500
1947	5	35,932	231.00	8,085	191,632	173,427	13,800	2,898	1,164,000	167,616	1,209,200	146,313	498,339
1948	5	10,007	88.00	3,080	44,328	40,119	4,700	1,020	431,800	77,292	526,500	70,024	191,535
Totals		2,052,286	35,311.99	$979,175	15,697,412	$12,015,227	7,882,328	$1,101,362	65,523,298	$4,596,001	15,156,496	$1,401,830	$20,093,595

[1] Cascade County created September 12, 1887. Table includes data from 1889-1920 for territory that became Judith Basin County in December 1920.
[2] Lode mines only, except where otherwise noted.
[3] Data not available.
[4] Includes one placer operation.
[5] Includes 0.87 ounce of placer gold.

The Little Belt Mountains are the eroded remains of a broad domal uplift caused by laccolithic intrustions (28). The sedimentary beds at the summits usually lie flat or are gently inclined (27). Around the northern borders of these mountains the beds are more steeply inclined toward the north and west, decreasing in dip with distance. Many local isolated domes extend in a northerly direction from the main domal uplift. Several of these structures occur in the southeastern part of Cascade County and in the western part of Judith Basin County. They form the irregular more prominent mountain peeks and high ridges which are separated by troughs along which erosion has exposed younger rocks surrounded by older ones. The summits of some of these outlying structures are capped with horizontal beds of sedimentary rocks. The sedimentary rocks have been removed completely from some domal structures, exposing the older pre-Beltian formations (fig. 2).

Belt Creek and its tributaries in the area around Neihart have cut into the surrounding plateau to a depth of about 2,000 feet. From Belt Creek the valley walls rise steeply to gently rolling surfaces at altitudes of 7,000 to 8,000 feet. Neihart Baldy Mountain and Long Baldy Mountain rise above these surfaces as rounded, dome-shaped hills (17). Both of these mountains are capped by the hard, erosion-resisting Neihart quartzite, the basal member of the Belt formation. The Neihart quartzite lies unconformably on the old eroded surface of the pre-Beltian gneisses and schists; it is about 600 feet thick and dips at a low angle toward the south. The upper members of the Belt series of thin-bedded slates and shales with occasional interbedded layers of limestone and quartzite are found farther to the south and east. Erosion has removed both the Neihart quartzite and the upper part of the Belt series, as well as all later formations, from an irregularly shaped area extending from about 1 mile south of the town of Neihart to a short distance south of the town of Barker, a distance of about 10 miles. The average width of the eroded area is about 8 miles. Archean or pre-Beltian rocks are exposed within this area (29)(17). These rocks are highly metamorphosed, contorted, red and gray gneisses and schists that have been intruded by igneous masses, dikes, and sills.

Most of the economically important metallic mineral deposits in Cascade County occur in fissures in the igneous rocks to the east and northeast of the town of Neihart. A few outlying deposits have been found along or near igneous-sedimentary contacts, but these have not been explored extensively and have produced only a small amount of ore.

A considerable amount of ore has been mined from claims in Cascade County just west of the county line near Barker. The metallic mineral deposits in this area are mainly replacements along or near the contact of intrusive rocks with Cambrian shales or Carboniferous limestone.

No metallic mineral deposits are known to be present in the sedimentary formations distant from the igneous rocks. Several deposits of nonmetallic minerals occur in the sedimentary beds at points not far distant from masses of igneous rock. These may have been formed by hydrothermal processes following the igneous activity. Other nonmetallic deposits occur interbedded with sedimentary formations that were unaffected by igneous or hydrothermal action.

LABOR SUPPLY AND WAGE SCALES

In the Montana (Neihart) and Barker districts mining has been done intermittently, depending largely on the price of silver. During the early days the claims were operated under lease, mainly by individuals or small companies. During boom times, when larger companies operated in the two camps, the scale of wages prevailing in the Butte district usually was adopted. In recent years most of the miners have drifted away. If operations should be resumed, skilled labor would have to be recruited from Butte or other mining centers. Unskilled laborers probably would be available during the winter months when farming and stock raising generally are curtailed.

Present wages in the Butte area range from $10.61 for surface labor to $12.36 for hoistmen per 8-hour shift. Miners, timbermen, underground shovelers, and underground mucking machine operators are paid $11.11 for an 8-hour shift. The rate for mill operators is $11.36. These rates are for a 40-hour week for men working on day shift. The afternoon, evening, and graveyard shifts are paid a differential of 4, 6, and 8 cents an hour in addition to the base rate. Time and one-half is paid for overtime.

MATERIALS AND SUPPLIES

Small tools, light mining equipment, and supplies can be obtained at Great Falls. Heavy mining and milling equipment would have to be obtained from Helena, Butte, or more distant supply points.

Mine timbers can be obtained locally from independent contractors. The cost of rough-sawn timber has increased considerably, owing to increased labor costs and to the greater length of haul. Plenty of small, lagging-size timber is available in the vicinity of Neihart and Barker.

Gasoline, Diesel oil, and lubricating oils are obtainable at Neihart or Monarch, where several oil companies maintain storage tanks. Where roads permit, the oil companies will deliver their products to the mines. The price of fuel oil used for heating purposes, deliv red at Neihart, was 15 to 16 cents a gallon in September 1949.

Explosives suitable for mining purposes are available in small quantities from dealers in Neihart and Monarch. Larger quantities are available at Great Falls. Prices for mining explosives are comparable with prices prevailing at Butte. They range from $14.75 to $23.75 a hundred pounds, depending on the type, strength, and quantity.

POWER

The Neihart and Barker districts have been supplied with ample electric power for many years by the Montana Power Co. This company's 110,000-volt transmission lines, extending south from Great Falls to Two Dot, pass through Monarch and Neihart. These lines are interconnected with the recently constructed 110,000-volt transmission lines that extend from Great Falls to Stanford and Harlowton.

A large transformer station is maintained near Monarch. From this station, 23,000-volt distribution lines extend to Barker, Hughesville, and Neihart. Branch lines serving the mines in these areas are being maintained in good condition. As the two main 110,000-volt transmission lines are interconnected between Two Dot and Harlowton, either or both of them can be utilized at Neihart; time loss due to power-line failures can be kept at a minimum.

Charges for electric energy supplied by the Montana Power Co. are based on a sliding scale for actual kilowatt-hour consumption plus a charge based on peak demand.

Montana Power Co. Schedule GS-44, approved by the Montana Public Service Commission in September 1944, became effective October 1, 1944. The rates are as follows:

Montana Power Co. Power Rates - Schedule GS-44

$0.75 for the first 12 kw.-hr. or less.
.035 per kw.-hr. for the next 288 kw.-hr.
.025 per kw.-hr. for the next 1,500 kw.-hr.
.015 per kw.-hr. for the next 3,200 kw.-hr.
.009 per kw.-hr. for the next 15,000 kw.-hr.
.007 per kw.-hr. for the next 200 kw.-hr. per kw. of demand.
.005 per kw.-hr. for all additional kw.-hr.

Plus demand charges:

First 10 kw.	No charge
Next 20 kw.	$0.95 per kw. of demand
All additional kw.	.75 per kw. of demand

The hydroelectric generating plants of the Montana Power Co. near Great Falls have a total capacity of about 235,000 horsepower.

From Great Falls, high-voltage transmission lines extend to most of the larger communities in central and western Montana; they are interconnected with lines from other generating plants owned by the Montana Power Co. Low-voltage lines extend through many rural areas and to most of the mining districts in the western part of the State.

TRUCKING RATES

Trucking rates from the mines to the railroad or smelters depend on road conditions, road grades, loading and unloading facilities, size and regularity of shipment, and the length of the haul. Before 1943, when the railroad served Neihart and Barker, ore and concentrates were loaded directly into railroad cars by the operators or were transported for comparatively short distances from the mines to loading platforms on the railroad. Since the removal of this railroad, most of the silver-lead ores and concentrates have been trucked directly from the mines or mills to the smelter at

East Helena. This has been found to be more economical than trucking to Armington and shipping from there to East Helena by rail; it avoids reloading into cars and the higher rail freight rates for the higher grades of ore or concentrate. During the spring of 1949, the contract truck haulage cost from Neihart to the East Helena smelter via Armington and Great Falls, a distance of 160 miles, was $6 a ton, or about $0.0375 a ton-mile. When trucked via White Sulphur springs and Townsend, a distance of 118 miles, the rate was $0.050 a ton-mile.

Zinc concentrate sent to the zinc plant at Great Falls is shipped by rail from Armington, as there are no facilities for handling truck loads at the zinc plant. The contract price for hauling zinc concentrate from Neihart to Armington in the spring of 1949 was $2.50 per ton. This price included loading into cars at Armington.

RAILROAD FREIGHT RATES

The only railroad point in Cascade County from which ores and concentrates now are shipped to Montana smelters is Armington on the Great Northern Railroad. Railroad freight rates on ores and concentrates per ton in minimum 30-ton carload lots as of October 1949 from Armington to the three Montana smelters via the Great Northern Railroad were as follows:

Value per ton, not exceeding -	$15	$25	$35	$50	$100	Over $100
To A.S. & R. Co. smelter, East Helena, Mont.	$2.41	2.94	3.47	3.86	4.13	4.66
To Washoe Sampler, A.C.M. Co., Butte, Mont.	3.34	3.72	4.31	4.76	5.05	5.65
To A.C.M. Co. zinc plant, Great Falls, Mont.	1.49	1.63	1.93	2.23	2.39	2.53

SMELTER SCHEDULES

Most western smelters generally find it impossible to quote a direct blanket or open schedule for the purchase of certain ores and concentrates until applicable schedules can be established upon the analysis of representative samples submitted by the prospective shipper. In many instances, favorable schedules are negotiated and based on contractual tonnage agreements between the shipper and the smelter.

The following schedules for ores and concentrates at smelters in Montana have been summarized from those in effect October 1949.

East Helena smelter, American Smelting & Refining Co., copper-lead-gold-silver ores and concentrates

Payments for metals:

Gold - minimum paid for, 0.03 ounce per ton.

Ounces per ton	Per ounce
0.03 to 3.0	$31.81825
Plus 3.0	32.31825

Silver - pay for 95 percent at average of the Handy & Harman, New York quotations, or Mint price, less minimum deduction 1 Troy ounce per dry ton.

Lead - If 3 percent or over by wet assay, deduct from wet assay 1.5 units (a unit is 20 pounds) and pay for 90 percent of the remaining lead at the average of the daily published A.S. & R. Co. quotations for common desilverized domestic lead for delivery in New York City, less 1.8 cents per pound of lead accounted for.

Copper - If 1 percent or over, deduct from wet copper assay 1 unit and pay for 100 percent of the remaining copper at daily net refinery quotations for electrolytic cathodes as published in E. & M. J. Metal & Mineral Markets of New York, less a deduction of 6 cents per pound of copper accounted for.

Deductions:

Base charge - $8 per net dry ton for treatment of ores and concentrates having a settlement lead content of 20 percent or less; deduct 10 cents per ton for each unit of lead over 20 percent, fractions in proportion; $7 per ton for those having no payable lead content.

Arsenic and antimony (combined) - 2 percent free; excess charged at 50 cents per unit, fractions in proportion. 0.1 percent of lead content by wet assay allowed free; excess charged at 50 cents per pound.

Zinc - 10 percent free; excess charged at 30 cents per unit, fractions in proportion.

Sampling and assaying - Charge $10 per lot when less than $200 value and $20 per lot when over $200 value for shipments of less than 5 tons dry weight. Charge $5 per lot when less than $200 value and $10 per lot when over $200 value for shipments less than 10 tons dry weight.

Washoe sampler, Anaconda Copper Mining Co., Butte, Mont., copper, gold, and silver ores and concentrates

Payments for metals:

Copper - 96 percent of copper content, with minimum deduction of 10 pounds per ton, at E. & M. J. average price of electrolytic copper for week ending Wednesday preceding date of sampling, less 2.5 cents per pound.

Silver -	95 percent of silver content, with minimum deduction of 1 ounce per ton at Government price less 2 cents per ounce. Silver not eligible for Government price will be paid for at open market quotation, as quoted by E. & M. J.
Gold -	95 percent of gold content, with minimum deduction of 0.01 ounce per ton, at $20 per ounce, plus 90 percent of premium in excess of $20.67 per ounce. (This is equivalent to paying for 100 percent at $31.81825 per ounce.)

Treatment charge, f.o.b. Washoe sampler, Butte, Mont.:

Base charge - $4 per ton.
Add 10 percent of sum of metal payments in excess of $15 per dry ton.
Add 12 cents for each 1 percent iron (Fe).
Deduct 2.5 cents for each 1 percent of silica (SiO_2) in excess of alumina (Al_2O_3)
Maximum total treatment charge to be $5.50 per dry ton.

In case company elects to have shipments made direct to the smelter at Anaconda for sampling, the base treatment charge will be $3.75 per dry ton, f.o.b. Anaconda Reduction Works, Anaconda, Mont., with maximum total treatment charge of $5.25 per dry ton. Lots of less than 10 tons will be assessed an extra sampling charge of $5 flat on each lot.

Electrolytic zinc plants, Anaconda Copper Mining Co. at Anaconda and Great Falls, Mont., zinc concentrates

Schedules for the treatment of zinc ores or concentrates at the Great Falls and Anaconda zinc plants are not quoted by the Anaconda Copper Mining Co. Because certain impurities complicate the treatment at these plants, only certain types and grades of zinc concentrates are acceptable. Acceptability is determined only after complete analysis of a representative sample of the zinc concentrate involved. If satisfactory, the prospective shipper then will be offered terms of purchase.

Terms of purchase of acceptable zinc concentrate by these zinc plants are indicated by the following, which pertain to shipments made by one producer in the Neihart area during the spring of 1949:

Payments for metals in zinc concentrates:

Zinc..........	Eighty percent (80%) of zinc content at St. Louis price for prime western zinc.
Lead..........	Eighty percent (80%) of lead content in excess of 3 percent at New York price, less 2 cents per pound.
Silver........	Eighty percent (80%) if 1.0 ounce per ton or over.
Gold..........	One hundred percent (100%) if 0.01 ounce per ton or over, at $27.024 per ounce.

Other metals..No payment shall be made for any other metal or metals contained in concentrates, and such metals shall be the property of the Anaconda Co.

Prices for zinc and lead shall be those quoted by Engineering & Mining Journal for week of arrival of concentrates at plants of Anaconda Co.

Treatment charge:

Base treatment charge shall be thirty dollars ($30) per dry ton of concentrates delivered and accepted, based on St. Louis price of prime western zinc of 10-1/2 cents (10-1/2¢) per pound; a cost of labor in the zinc plants of the Anaconda Copper Mining Co. at Anaconda and Great Falls, Mont., based at $11.40 per 8-hour day with the addition to or subtraction from said base treatment charge per dry ton of concentrates of 1 cent (1¢) for each 1 cent (1¢) increase or decrease in said cost of 8-hour day employment; a lead content of 3 percent (3%); and arsenic plus antimony content of 0.125 percent.

There shall be added to or subtracted from said base treatment charge, 1 dollar ($1) per dry ton of concentrates for each 1 cent (1¢) per pound increase or decrease in the price of prime western zinc at St. Louis above or below 10-1/2 cents (10-1/2¢) per pound, fractions proportionately. Fifty cents (50¢) per dry ton of concentrates shall be added to said treatment charge for each percent (1%) lead below 3 percent (3%) in such concentrates, fractions in proportion. Twenty-five cents (25¢) per dry ton of concentrates shall be added for each 1 percent (1%) of insoluble material plus iron. Twenty cents (20¢) per dry ton of concentrates shall be added for each 0.10 percent arsenic plus antimony in excess of 0.125 percent.

Treatment charges for typical shipments of zinc concentrates sold during 1949 to the Great Falls zinc plant by one Neihart producer ranged from $37.22 per dry ton for concentrates containing over 50 percent zinc to $43.34 per dry ton for concentrates containing 43.3 percent zinc.

The zinc concentrates produced in the Neihart and Barker districts contain small amounts of arsenic, antimony, cadmium, bismuth, indium, and other metals, in addition to the lead, zinc, silver, and gold paid for by the smelters or zinc refineries. Cadmium, bismuth, and indium are recovered at Great Falls in a special plant where zinc-tank slimes from the electrolytic plant are treated. Production of these metals from the smelted zinc-tank slimes has been improved by the installation of a new-type centrifugal casting machine. The cadmium plant has a reported capacity of 150,000 pounds of cadmium metal a month. Approximately 1 pound of indium metal is recovered for each 2,000 pounds of zinc produced by the refinery. No data on the quantity of bismuth recovered are available.

METALLIC MINES AND MINERAL DEPOSITS

General

Metal mining in Cascade County has been confined mainly to the silver-lead-zinc deposits in the southeastern part of the county in the area around

Neihart and west of Barker (fig. 1). A number of gold, lead, copper, and iron deposits in the mountainous areas north and west of Neihart have been explored, but none of them have been developed extensively; production from them has been small.

Gold placer deposits were discovered in many of the gulches on the north side of the Little Belt Mountains. These deposits, now in Judith Basin County, were worked on a small scale during the 1880's but generally proved unprofitable and were abandoned. Gold placers have been worked intermittently by small-scale manual methods at several localities in Cascade County. The deposits were small and produced only a very small amount of gold.

Since the first discovery in 1881, the mines in the Montana (Neihart) district have yielded by far the greater part of the metallic mineral production of the county. However, most of these mines have been operated intermittently; many have been inactive for some years.

Mines in the Barker district produced a considerable amount of silver-lead ore before 1920, when most of the district became a part of Judith Basin County. Since 1920 a few mines on the Cascade County side of the Barker district have been operated intermittently; their production has not been large.

The Carbonate or Logging Creek district is about 14 miles northwest of Neihart. A large number of claims were located in this district years ago; many were patented. A few of the patented claims extend over the divide into Meagher County. Very little developing has been done. When visited in 1949, there was no activity; most of the old mine workings were caved or otherwise inaccessible.

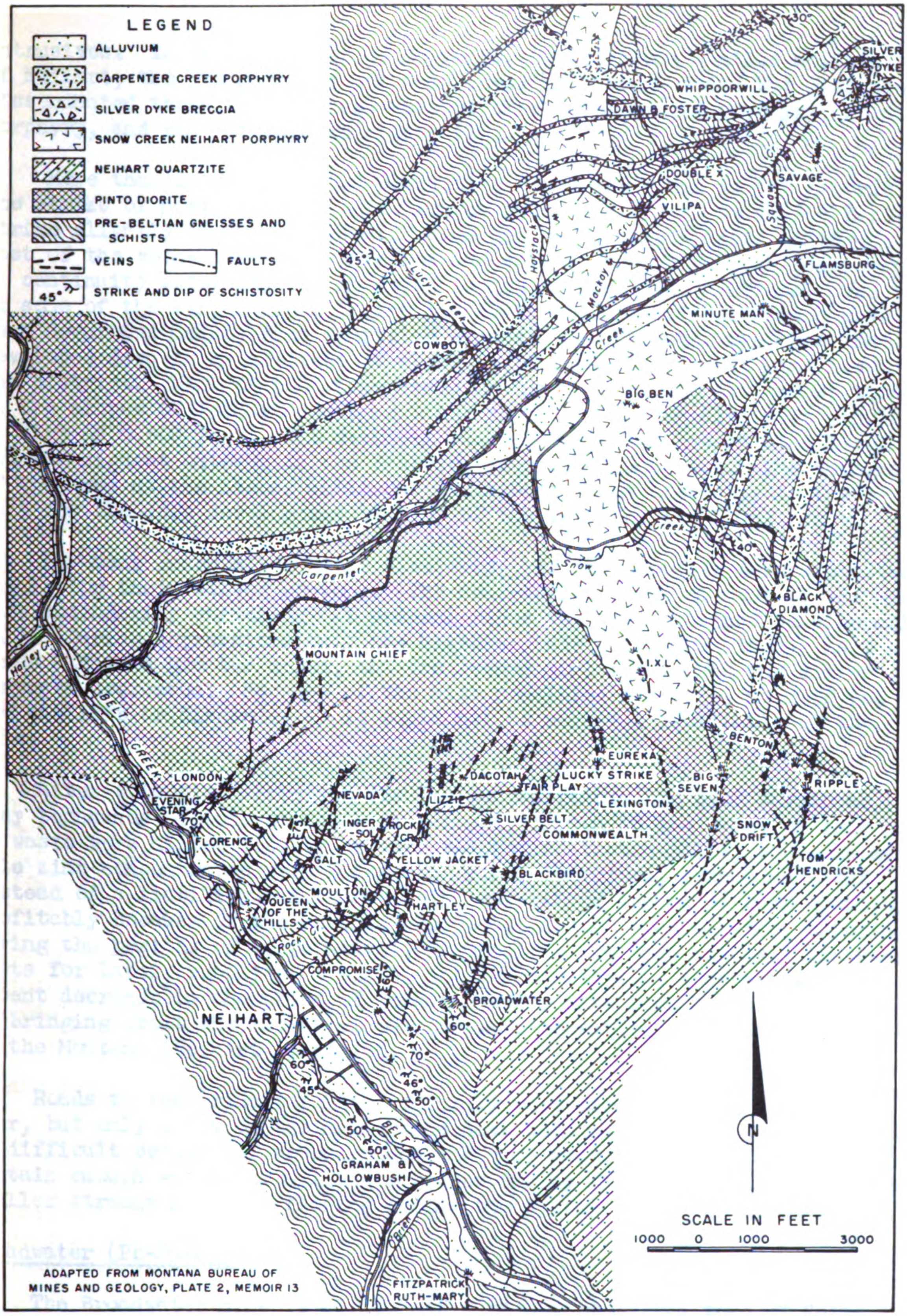
The Thunder Mountain district is of interest mainly because of it iron ore deposits.

The principal metallic mines and mineral deposits are described under the four district headings. The locations of the properties investigated are shown by symbol and number on the accompanying Minerals Industry Survey map. The symbol refers to the predominating or principal metal or metals, although such differentiation often is difficult because of varying metal content. The number designates the property referred to in the Minerals Industry Survey table that accompanies the map. This table provides summarized information on the metallic mines and mineral deposits investigated and on other prospects on which only very limited information is available.

Montana (Neihart) District

The Montana (Neihart) district includes the area within a radius of about 5 miles of the town of Neihart. Most of the larger mines are within 1 to 3 miles; some are within the Neihart townsite limits (fig. 3).

The ore deposits occur principally in veins traversing pre-Beltian gneisses and schists or along the contacts of these rocks with later



ADAPTED FROM MONTANA BUREAU OF MINES AND GEOLOGY, PLATE 2, MEMOIR 13

Figure 3. - Geologic map showing principal mines, Montana mining district, Cascade County, Mont.

intrusives. In an area north of Carpenter Creek, about 4 miles northeast of Neihart, the ore minerals not only occur in fissure veins but also are disseminated throughout a large mass of brecciated quartz porphyry, granite porphyry, and some brecciated gneiss (17).

More than 20 well-defined productive veins are known in the district. The strike of most of these veins ranges between N. 5° E. to N. 30° E.; some strike slightly to the northwest. Some dip west, others east. Although most of the veins have some branches and splits, they have been persistent in continuity laterally and in depth to the deepest mine workings. The veins at some of the larger mines in the immediate vicinity of Belt Creek have been developed mainly from shafts or winzes. The Florence mine has been developed down to an altitude of about 5,070 feet, the lowest mine level in the district. Most of the other mines are at much higher altitudes; those on the slopes of Neihart and Long Baldy Mountains are at altitudes ranging as high as 8,300 feet. The vertical range between the lowest mine level and the highest outcrop in the district is about 3,200 feet. The topography of the area at the higher altitudes above Belt Creek generally is favorable for the deep development of many of the veins by low-level adits.

For many years after their discovery, the ore deposits were exploited mainly for their silver content. The near-surface ores at most of the mines were secondarily enriched. At several mines the ore contained considerable gold. During depressions only the highest-grade ores were mined. As the mines attained greater depth, the ore became more base; gold and silver contents decreased. Because of the high penalties for zinc, much of the ore was left or discarded as it could not be marketed profitably at the time.

After selective flotation for ore concentration had been developed, many thousands of tons of material formerly thrown on the dumps or into gobs as waste were milled locally or were shipped to custom mills, where marketable zinc concentrates were produced. Zinc, therefore, became an asset instead of a liability. More recently, several of the mines were operated profitably because of the revenue derived from zinc concentrates, especially during the periods of comparatively high prices for base metals. Increased costs for labor, supplies, freight, and transportation, together with the recent decrease in the price of lead and zinc, have been largely instrumental in bringing about the recent almost complete cessation of mining activities in the Montana (Neihart) district.

Roads to the principal mines formerly were accessible during most of the year, but only a few of the main roads have been maintained. Winter travel is difficult because of steep grades and deep snow. Belt and Carpenter Creeks contain enough water for milling purposes during the greater part of the year. Smaller streams may stop flowing during the winter and early spring.

Broadwater (Pb-Zn-Ag)

The Broadwater mine is about half a mile east of the town of Neihart on the west slope of Neihart Baldy Mountain. The claims were located in 1881 but were not actively prospected until 1886, when Colonel Broadwater acquired control. The ore bodies developed at that time were not considered sufficiently high grade to warrant further development; all work was suspended. In 1892 the property was sold for $165,000 to W. J. Clark (18). The new owner at once began extensive operation; large bodies of argentiferous galena were found. The mine yielded over 1,000,000 ounces of silver during the next 2 years. Up to 1895, net profits are reported to have been $465,000, even though silver prices were very low. In December 1896, the ore was thought to have been exhausted. New ore shoots, however, soon were discovered.

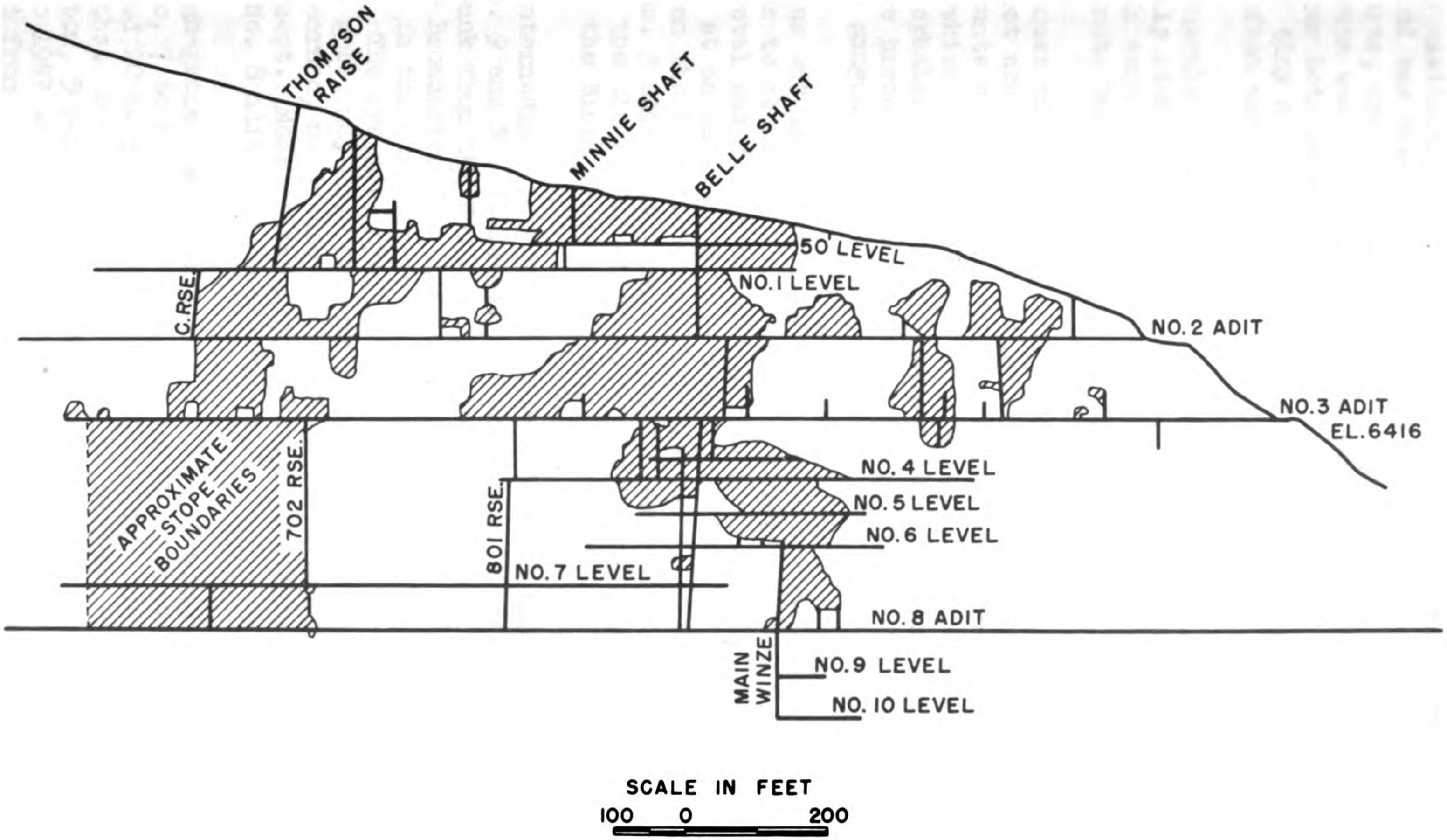
Control of the property then was acquired by John E. Searles; the mine was operated by the United Smelting & Refining Co., 112 miners and topmen at one time being employed (1). From January to July 1897, ore shipments averaged three carloads a week; they were then increased to 15 carloads (300 tons) a week (29). Company operations were discontinued in 1898; the mine was turned over to leasers (2). Some blocks of ore left by the company were mined during 1898-1900. In 1901 the Broadwater mine was purchased for the Diamond R. Mining Co. by a Mr. McClure (3). Operations continued more or less continuously until 1922, when the mine was closed. During the period 1901-22, net smelter returns for ore shipped are reported to have been $114,870.72, or a gross value of about $150,000 (17).

Control of the property was taken over later by the Broadwater Consolidated Mines Co. During 1928 and 1929, additional developing was done. This work is reported to have blocked out approximately 24,000 tons of ore between the No. 3 and No. 8 adit levels. It was not until 1940 that mining and milling of this ore was undertaken by the Klies Mining Co. A new selective flotation mill with a capacity of about 100 tons a day was constructed. Operations were continuous until 1947, by which time all of the easily available ore had been mined or pulled from the old stopes. During this 8-year period, 108,214 tons of ore was mined. From this ore, 822 ounces gold, 381,850 ounces silver, 61,832 pounds copper, 5,974,967 pounds lead, and 7,472,786 pounds zinc were recovered (14). Production of the Broadwater mine before 1940 has been estimated to have had a value of about $5,000,000.

The Broadwater claim now is owned by the estate of R. E. Paine, 50 Congress Street, Boston, Mass. The other claims in the Broadwater group are owned by the Broadwater Consolidated Mines Co., c/o H. L. Maury, Butte, Mont. All mine workings were inaccessible in 1949.

According to Weed (29), "the main vein is strong and well-defined and traverses light-colored schists and reddish or streaked-gray feldspathic gneisses, which it crosses at nearly right angles throughout the greater part of its extent as developed. At the extreme northern end, the level penetrates Pinto diorite. Offshoots and splits are numerous, mostly from the hanging wall, but are not large or important." Horses of rock to 50 feet in length and to 25 feet in width were sometimes encountered. At the southern end of the property the workings indicated branching of the vein.

The vein (fig. 4) ranged from 3 to 6 feet in width. The walls were hard and well-defined. The vein material was mainly of altered country rock; it



ADAPTED FROM PLATE 7, MONTANA BUREAU OF MINES AND GEOLOGY MEMOIR NO. 13

Figure 4. - Longitudinal section of main Broadwater mine workings, Montana district, Cascade County, Mont.

was usually distinctly banded or sheeted. In some parts of the mine the vein material was brecciated, fragments of country rock being cemented by barite, quartz, ore minerals, and to a lesser extend by clay. In places where the vein was 4 to 6 feet wide, streaks of ore 3 to 8 inches wide occurred near both walls, either frozen to the walls or separted from them by bands of clay a few inches thick. This clay, owing to films of silver sulfides, often was rich ore.

Ore minerals often occurred across the entire width of the vein in the exceptionally rich ore shoots where sheeted or banded structure was not pronounced. In some places, however, the banded structure was very marked owing to minute bands of spar in the darker sulfides.

As in most of the mines in the district, galena, sphalerite, and pyrite were the most abundant sulfide minerals. Associated with these minerals were smaller amounts of chalcopyrite, polybasite, pyrargyrite, pearceite, and proustite, which usually occurred as coatings or as small inclusions in the galena and sphalerite. Ankerite, cerussite, siderite, and other carbonates usually were present in the oxidized zone. Barite, rhodochrosite, and quartz were common gangue minerals.

The mine was developed by three adits, two shafts, numerous raises, and a winze sunk to about 125 feet below the lowest, or No. 8, adit level (fig. 4). The No. 8 level was driven along the vein for about 2,800 feet. The No. 3 adit level, at an altitude of 6,416 feet, or 300 feet above the No. 8 adit, was driven on the vein for about 2,400 feet. The No. 2 adit level, 100 feet above the No. 3 adit, was driven about the same distance. Other levels driven from the old shafts extended northward and were connected by raises to workings of the Black Bird and Silver Belt mines.

Five intermediate levels were driven between the No. 3 and No. 8 adit levels. No. 9 and No. 10 levels were driven short distances southward from the winze sunk from the No. 8 adit level, but no stoping was done. Development by the Broadwater Consolidated Mines Co. in 1928-29 was mainly on the No. 7 level in the northern part of the mine, about 115 feet above the No. 8 adit level. The ore developed at that time, together with zinc ore formerly dumped into gobs, may have been mined later by the Klies Mining Co. As far as can be learned, no developing was done below the No. 8 adit level on the north ore shoot. Most of the mine openings were inaccessible in 1949. The lowest, or No. 8 adit, was closed by ice.

The high-grade ore mined before 1900 is reported to have contained 20 percent zinc, 7 to 8 percent lead, and 40 to 60 ounces silver. The low-grade ore contained 20 to 30 ounces silver (29). This ore probably was mined at shallow depths. Between 1901 and 1921, shipments average about 50 ounces silver per ton, 5 percent lead, and 7 percent zinc (17). The ore produced from 1940 to 1947 was mined at 500 to 800 feet below the surface; much of it was obtained from old stope gobs and dumps. Metal recovered from this ore per ton amounted to about 3.5 ounces silver, 2.7 percent lead, 3.4 percent zinc, and a small amount of copper and gold (14).

During the spring and summer of 1949, the King's Hill Mining Co., as lessees, milled unsorted dump material from the No. 3 and No. 8 adit dumps in the Neihart Mine & Milling Co.'s 125-ton flotation plant at Neihart. This mill formerly was owned by the Klies Mining Co. The dump material was mined by a 3/8-yard gasoline-powered shovel and hauled to the mill by trucks. About 65 tons of dump material averaging about 5 ounces silver, 1.0 percent lead, and 1.4 percent zinc was milled daily. A lead concentrate containing about 160 ounces silver, 65 percent lead, and 9 percent zinc was shipped to East Helena by truck. A zinc concentrate containing about 53 ounces silver, 5 percent lead, and 52 percent zinc was shipped by truck to Armington and thence by rail to the Anaconda Copper Mining Co. zinc plant at Great Falls. Mill tails contained about 2 ounces silver, 0.2 percent lead, and 0.5 percent zinc. The King's Hill Mining Co. operations were terminated in July 1949, when base-metal prices became too low for profitable operation.

Moulton (Pb-Zn-Ag)

The Moulton mine, another large producer, is on Rock Creek about one-fourth mile east of the north end of the main street of the town of Neihart. The claim was located in the early 1880's by Jonathan McAssey and was surveyed for patent in October 1888. It was owned and operated by the Diamond R. Mining Co. until July 1893. By that time the mine was credited with a total production of 450,000 ounces of silver (29). The gross value of the ore with the accompanying lead and zinc must have exceeded half a million dollars (17).

A gravity concentrator connected with the mine by a tramway was constructed at Neihart during the summer of 1899. Low-grade ore and ore from the dumps of the Moulton mine were treated in this concentrator during 1900. After 1901, the mine was relatively inactive until about 1917, when it was taken over by the Cascade Silver Mines & Mills Co. Active mining resumed immediately. The old mill was remodeled and during part of 1919 treated as much as 150 tons of ore a day. The mill burned in May 1921 and was not rebuilt. During 1918-23, inclusive, net smelter returns from ore or concentrates shipped aggregated $895,857.59 (17). Production of the Moulton mine to 1923 is estimated at approximately $1,500,000 (17). The property now is owned by the Broadwater Consolidated Mines Co., c/o H. L. Maury, Butte, Mont.

Several veins were developed, but the Moulton vein (fig. 5) was the only one mined. The Moulton vein has a strike about N. 30° E.; the dip ranges from 80° to 90° NW. The vein has been deflected on both sides of the Moulton fault, which crosses the main ore shoot at about its center. However, it soon resumes its normal strike (17). According to H. L. Maury, the fault itself contains segregations of ore minerals.

The Moulton vein is in pre-Beltian black mica schists and pink gneiss. It ranges in width from 3 to 7 feet. The vein material is mainly a crushed altered country rock containing disseminated sulfides, although bands or pay streaks to 2 feet in width occurred in the richer ore shoots. The ore minerals are mainly galena and sphalerite with small amounts of chalcopyrite, and pyrite. Intimately mixed with those minerals are proustite, pyrargyrite,

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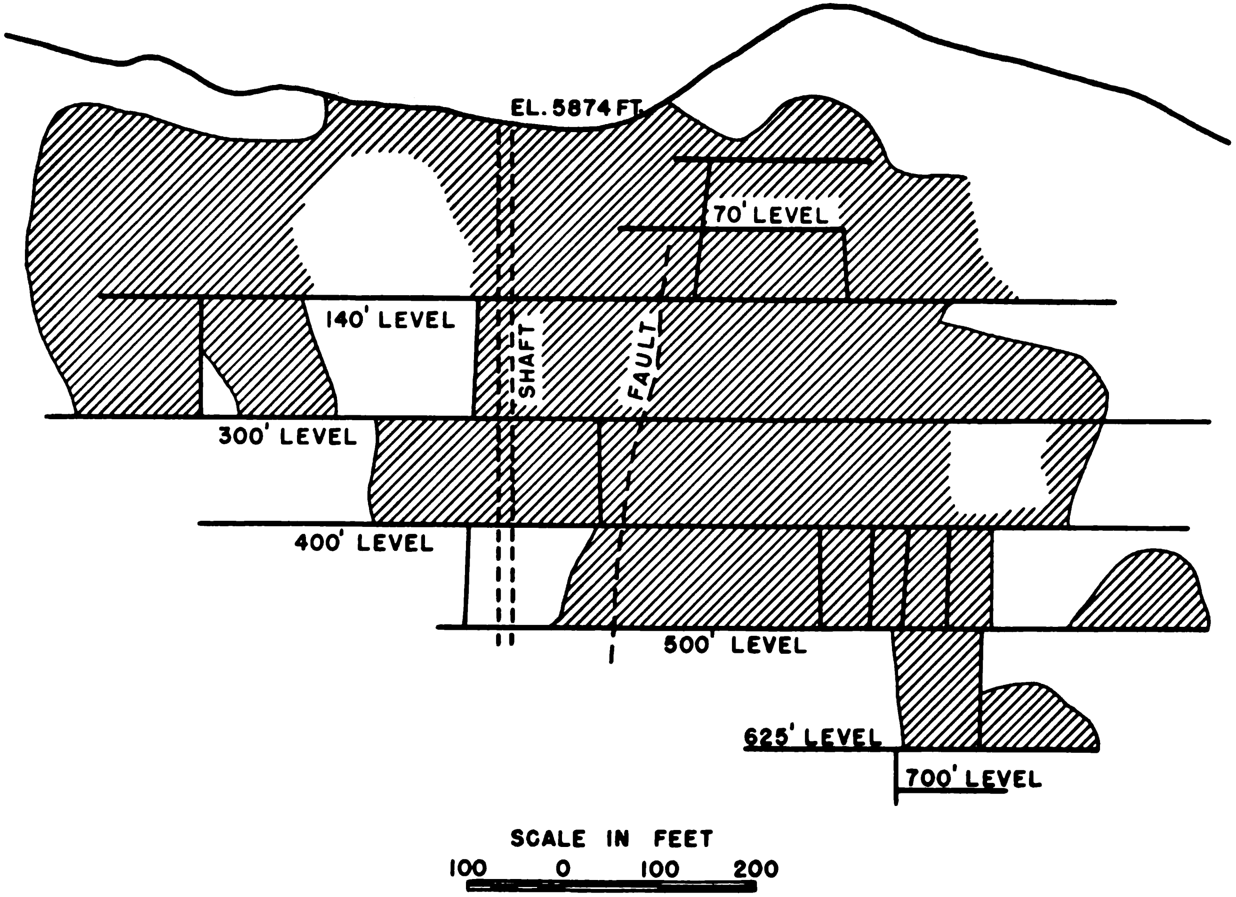


ADAPTED FROM FIGURE 7, MONTANA BUREAU OF MINES AND GEOLOGY MEMOIR NO. 13

Figure 5. - Longitudinal section of Moulton mine, Montana district, Cascade County, Mont.

pearceite, and polybasite. Ankerite, barite, rhodochrosite, and quartz are common gangue minerals, with siderite and cerussite usually present in the oxidized zone.

The mine was developed by two adits, a 550-foot 3-compartment shaft with levels at 100-foot intervals, a 125-foot winze from the 500-foot shaft level, and a winze from the 625-foot level to below the 700-foot level (fig. 5). One of the adits, known as the Blacksmith tunnel, was on the north side of Rock Creek. It was driven on a vein believed to be an extension of the vein on the South Carolina or Gem claim, which adjoins the Moulton on the north. No ore was encountered in this adit. The other adit, which is on the south side of Rock Creek, was driven partly on the Moulton vein and several other small veins and partly on the Moulton fault. Some ore was mined from one of the small veins developed by this working. Virtually all of the ore produced by the Moulton mine was mined from the shaft workings.

According to reports, most of the developed ore has been mined down to the 500 level, although some good ore remains. According to William Thorson, Great Falls, Mont., some ore, lower in grade than the average then desired, was left above the 140-foot and 300-foot levels to the north of the shaft. Some good ore was found on the 625-foot winze level, but only part of it was stoped as it contained considerable zinc; it could not be profitably mined and shipped. H. L. Maury states that good ore was found on the 700-foot level south from the lower winze where the vein was 6 or 7 feet wide and contained two rich pay steaks each about 12 inches wide. Drifting on this level was done by leasers, who produced one carload of ore that netted them $2,156. Further exploration on the lower levels ceased when the company closed the mine in 1923. Most of the higher-grade ore came from above the 300-foot level. Below the 300-foot level the ore contained more zinc and less silver. Average shipments from the lower levels contained about equal amounts of lead and zinc. It is probably that ore of milling quality exists to a considerable depth below the present mine workings (17). All of the mine workings were inaccessible in 1949.

Compromise (Pb-Zn-Ag)

The Compromise claim is one of the Moulton group. It is within the town of Neihart and extends across the main street near its northern end.

The claim was located March 15, 1884, by John Wilson, et al. The main vein first was prospected by an adit driven about 400 feet northward toward the Moulton claim, which adjoins at the north. In later years the property was operated by the Cascade Silver Mines & Mills Co., the Broadwater Consolidated Mines Co., and by various lessees. Before 1930 a main adit on the Compromise claim was driven on the Moulton vein and extended into the Moulton claim. Crosscuts to the east from this adit intersected other veins that extend into the Empire and the Unity claims adjoining the Moulton claim at the east. Some ore was produced from these workings, but this production has been included with that of the Moulton mine. About 1945 a 150-foot shaft was sunk by Spehn, Loberg, and Taylor at a point southeast from the portal of the main adit. A drift was driven northward for several hundred feet on the 120-foot level of this shaft. This work was terminated before the Moulton workings were reached. Since then no work has been done.

The veins on the Compromise and adjacent claims traverse various gneisses and amphibolites. They range from a few inches to 3 or 4 feet in width. The main, or Moulton, vein strikes about N. 15° E. and dips about 80° to 85°NW. The other veins strike N. 20°-50° E. and dip 50°-75°SE.

Because of its comparatively low altitude, the Compromise adit has been considered for use as a main haulage and exploratory adit. Its extension northward to the Moulton fault and thence southeasterly along the fault would provide a haulage way from which many of the veins in the claims farther east could be developed at a considerable depth below their present workings.

When visited in 1949, most of the main adit workings were open and in good condition. The shaft workings were partly filled with water.

Unity and Rochester (Pb-Zn-Ag)

The Unity and Rochester claims are included in the Moulton group. Both claims are east of the Moulton claim. The Unity claim was located February 15, 1889, by Edgar A. Maclay, et al. The Rochester claim was located May 1, 1884, by James F. Menefee, et al. Both claims now are owned by the Broadwater Consolidated Mines Co.

Several veins were exposed in surface workings on both claims. An adit crosscut, known as the Rochester adit, was driven eastward from the Unity claim for about 540 feet. Short drifts were driven on several veins intersected by this adit, from which some ore was mined.

The extension of the Rochester adit has been considered a means for developing veins on claims farther east. This adit was inaccessible in 1949.

Florence Mine (Ag-Pb-Zn)

The Florence mine is about one quarter of a mile north of the north end of the main street of Neihart. The main workings are in the steep hillside on the east side of Belt Creek. The Florence claim was located November 18, 1886, by Richard G. Wight, et al. The mine was operated first by the Florence Mining Co., which began operations during the summer of 1889. The lower adit was driven 420 feet; a winze had been sunk 65 feet by 1891. Some ore was produced and shipped to the smelter at Great Falls (9). When the mine shut down in 1893, the winze had been sunk to the 100-foot level with drifts started on the 50-foot and 100-foot levels (10).

The mine was idle until 1895, when it was purchased by the Florence Mining & Milling Co. Unitl 1910, operations were nearly continuous. During this 15-year period, the mine was developed by six adits. The No. 1 adit, about 30 feet above Belt Creek, is about 1,000 feet long. No. 2 adit, about 50 feet above No. 1, is 650 feet long. No. 3 adit, 200 feet above No. 1, is 600 feet long. No. 4, No. 5, and No. 6 adits, at successive 100-foot intervals above No. 3, are each about 400 feet long. A two-compartment winze was sunk at a point 135 feet in from the portal of No. 1 adit to a depth of 500 feet. Levels were driven at 100-foot intervals. These levels, Nos. 1, 2, 3, 4, and 5, extend, respectively, 960, 750, 565, 450, and 300 feet to the north and 130, 190, 240, 290, and 350 feet to the south. The south drifts, except those on the No. 3 and No. 5 levels, terminate at the Moulton fault. The No. 3 and No. 5 levels were driven through the fault; short crosscuts were driven east and west in attempts to locate the continuation of the vein. Two small veins were intersected, but neither proved to be the main vein (17). In 1910 the lower part of the mine was allowed to fill with water. All production after that time was made form the adit levels or from a resorting of the dumps. In 1949, most of the No. 1 adit workings were accessible. All other mine workings were inaccessible; the winze was filled with water.

Sometime between 1910 and 1916, the Florence, M & I, British Lion, Concentrated, and Monarch claims, which comprise the group, were purchased by Allen Pierse and E. A. Shaw. From 1916 to 1931 about $80,000 worth of ore was produced by lessees. From 1932 to 1935 the mine again was idle. In 1935 the Florence Co. obtained a lease and bond on the properties from the M & I Mining Co., which was owned mainly by Pierse and Shaw. The Florence Co. operated the mine until April 1943. The M & I Mining Co.'s 60-ton flotation mill was operated until June 30, 1943, when the properties and all equipment, including the mill, were sold to the Bennett Mining Co. (22-1943). This company still owns the mine but has not operated it.

Production of the Florence mine from 1901 to 1943, inclusive, is reported to have been 105,189 tons, from which 98.39 ounces gold, 2,015,666 ounces silver, 11,166 pounds copper, 4,323,319 pounds lead, and 4,724 pounds zinc were recovered (14). Early shipments of ore to the smelters are reported to have contained 50 to 200 ounces silver per ton, 4 to 10 percent lead, and 3 to 10 percent zinc (17). The zinc in the ores and concentrates then shipped was not accounted for, but the quantity must have been nearly as large as that of the lead recovered.

According to Weed (29), four well-defined veins occur within a width of 300 feet. Only two of these had been prospected on the surface. The Concentrated vein, to the north of the main Florence vein, was drifted on for about 1,500 feet. It was reported to have averaged 3-1/2 feet in width and to have contained a large tonnage of milling ore. A crosscut from the end of the No. 1 adit encountered another vein. No work has been done on these veins since the 1890's (17). Other crosscuts to the northwest from the main adit level encountered two veins, both of which were drifted on for unkown distances. The first vein, about 35 feet north of the main vein, was stoped north of the crosscut both above and below the level. The other vein, about 195 feet northwest from the main vein, was stoped for a short distance.

According to L. B. Stark, Neihart, Mont., a hole diamond-drilled west from the 300-foot winze level cut a vein about 7 feet wide that was reported to have contained ore assaying 22 ounces silver a ton. This vein may be the downward extension of the Concentrated vein or one of the other veins encountered to the north of the Florence vein.

The Florence vein, striking about N. 10° E., ranges from about 4 to 6 feet in width. It occupies a well-defined, nearly vertical fissure mainly in gray feldspar gneiss but otherwise in black amphibolite. Within the vein the pay streak varied in width and position, sometimes filling the entire width of the vein. Splits in the vein usually contained richer ore for short distances than the main part. The sulfide minerals are galena, sphalerite, pyrite, polybasite (or pearceite), proustite, tetrahedrite, and a little chalcopyrite. Gangue minerals are barite, ankerite, and quartz.

The ore was secondarily enriched near the surface, but the bulk of the mining was done in primary ore (17). The ore above the developed parts of the main vein has been mined rather completely. The ore on the 500 or bottom winze level is reported to have been somewhat lower in grade than that at the higher levels, but the vein was proportionally wider.

Hartley (Ag-Pb-Zn)

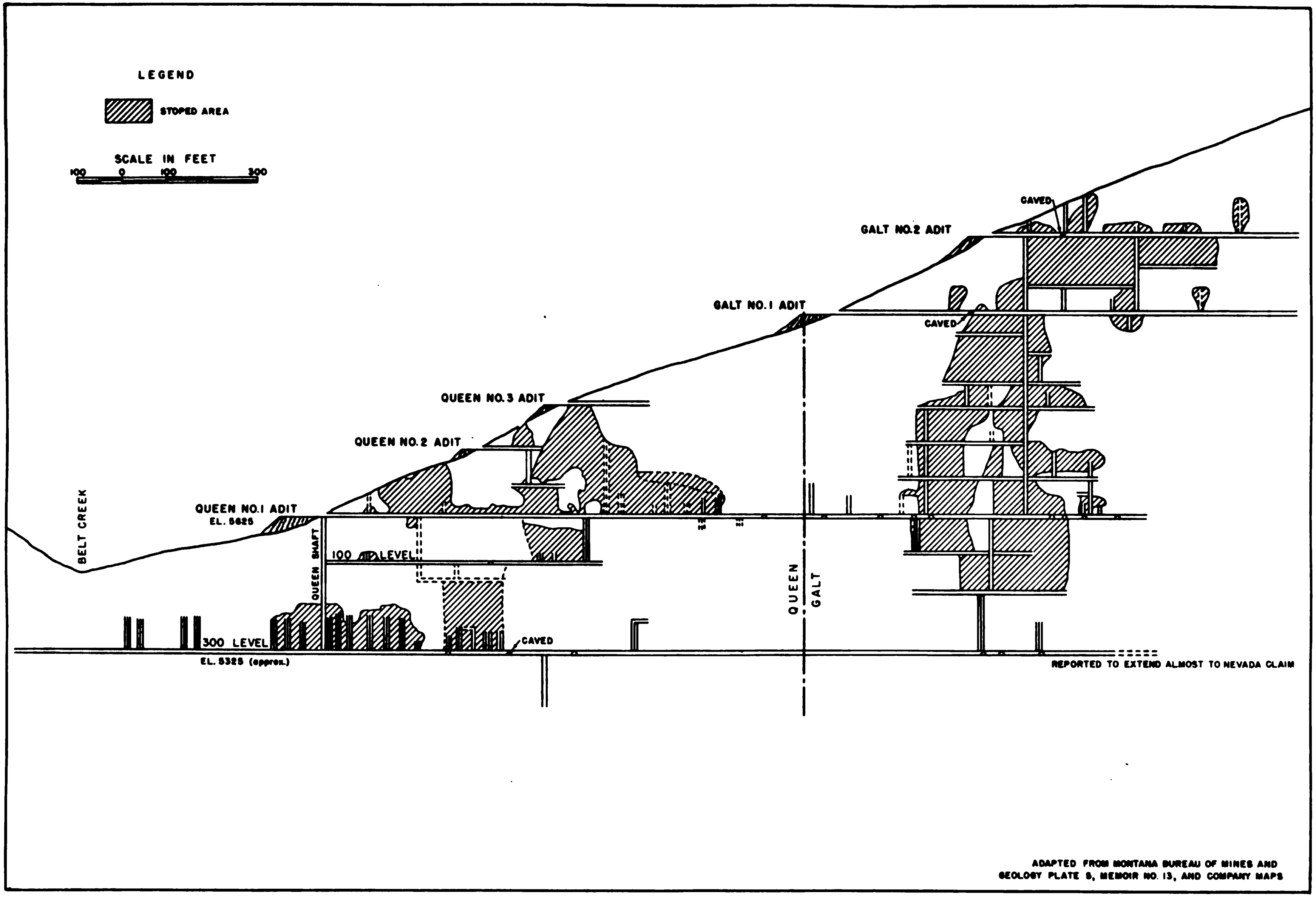
The Hartley mine is about half a mile northeast of the town of Neihart on the northwest side of Neihart Baldy Mountain. It is about three-eights of a mile east from the Moulton mine and about the same distance north of the Broadwater mine.

The property was located June 20, 1883, by Thomas Angers, et al. It was acquired later by William Mueller, who began shipping ore in 1901. Between 1901 and 1917, Mueller mined and shipped ore valued at $170,698.09 (17). During this time the main adit level was lengthened to about 1,000 feet; a winze was sunk from this adit level to a depth of 200 feet. Little mining was done from 1917 to 1919. Mueller sold the property in 1920 to the Neihart Consolidated Silver Mining Co. After this company obtained the property, the winze was sunk to a depth of 500 feet. Nearly all of the vein above the 500-foot level was mined for a length of about 400 feet (17). Company operations ceased in 1924. Later operations were conducted by lessees.

A small mill was operated on material from the Hartley dumps during 1928, when 380 tons of concentrates were produced. These concentrates, containing 12.1 ounces gold, 640 ounces silver, 171,803 pounds lead, and 454 pounds zinc, had a value of $38,038.82 (17). The mine was idle from 1929 to 1933. It was reopened in 1934 and operated continuously until 1940.

During 1939 and 1940, the property was operated by Stewart and McVeda (21). Production during 1939 is reported to have been valued at about $17,000. The ore was milled in a 35-ton flotation plant operated by the Ruby Silver Mines, Inc. (22-1940). The mine has been idle since 1940. The property, consisting of eight patented claims, now is owned by the Neihart Consolidated Silver Mining Co., Great Falls, Mont. All mine workings were inaccessible in 1949.

Production from the Hartley mine from 1901 to 1940, inclusive, it reported to have been 64,423 tons or ore, from which were recovered 164.04 ounces gold, 1,535,426 ounces silver, 10,028 pounds copper, 3,894,765 pounds lead, and 3,000 pounds zinc (14).



ADAPTED FROM MONTANA BUREAU OF MINES AND GEOLOGY PLATE 5, MEMOIR NO. 13, AND COMPANY MAPS

Figure 6. - Longitudinal section of the Queen-Galt vein, Montana district, Cascade County, Mont.

Three or more veins are known in the Hartley group of claims. Virtually all ore mined came from the main or No. 3, vein. Some ore was mined by Mueller from shallow workings in the No. 2 vein, but this vein never was developed at depth (17). The veins occur in gray and red gneiss. The main or No. 3 vein occupies a well-defined fissure ranging in width from a few inches to several feet. It strikes about N. 10° E. and has an average dip of 50° NW. The main ore shoot was about 600 feet long; it narrowed at the north end and terminated at a fault at the south end. The ore shoot raked about 50° toward the south. Banding was conspicuous; druses lined with quartz were of frequent occurrence. Wall rocks were not intensely altered but contained some sericite, kaolin, and fine-grained pyrite.

The sulfide minerals were chiefly galena, sphalerite, and pyrite in a gangue of crushed, altered gneiss and quartz with ankerite and barite. The silver minerals were chiefly polybasite (or pearceite) and proustite. Native silver in the form of wire or threadlike masses was abundant in the upper workings, especially above the 300-foot winze level. Below the 200-foot level the silver content decreased markedly. Ore shipments from above the 200 level, mainly from the zone of secondary enrichment, contained from 56 to 203 ounces silver, 7 to 20 percent lead, 5 to 16 percent zinc, and 0 to 0.017 ounce gold a ton. Shipments from below the 200 level were mainly of primary ore; they contained 20 to 100 ounces silver, 5 to 15 percent lead, 2 to 10 percent zinc, and 0 to 0.02 ounce gold per ton. Near-surface ores contained considerable amounts of limonite, cerussite, smithsonite, and probably some calamine; native silver, proustite, pyrargyrite, and cerargyrite occurred, often abundantly (17).

The main vein is reported to have been about 4 feet wide on the 500 level and to have contained ore similar to that mined up to 200 level. Deeper development would be necessary before the ore below this level could be mined. The No. 2 vein, which produced ore above the main adit level, has not been prospected below that level. Other veins are known on the Boss claim, which adjoins the Hartley on the west. The north end of the property has not been prospected.

Queen of the Hills (Queen-O'Brien)(Pb-Zn-Ag)

The Queen of the Hills mine adjoins the Galt (fig. 6) and Equator mines at the west. The property was located in July 1881 by James J. Neihart and surveyed for patent in June 1884. First development exposed such favorable conditions that the Queen of the Hills claim, together with the Homestake and O'Brien claims, which adjoin on the south and north, respectively, was optioned in 1884 for $45,000. This option was relinquished the following year. Later development by the owners soon resulted in the discovery of large ore bodies, from which many shipments were made (17). After October 13, 1890, the property was owned and operated by the Queen of the Hills Mining Co. until July 1893, when operations were suspended owing to the low price of silver and lead (9). Operations were resumed in 1894 by the Queen Mining & Milling Co. By 1897 the main adit was about 1,000 feet long, and a three-compartment shaft had been sunk to a depth of 300 feet, with levels at 100 and 300 feet.

In 1897 the mine was closed, and the lower workings were allowed to fill with water (2). From 1898 to 1907 the mine was operated more or less continuously. Much of the ore produced during this period came from the O'Brien vein.

Intermittent operations have been conducted mainly by lessees since 1907. The Anaconda Copper Mining Co. at one time did considerable development on the 300-foot level. The mine was operated from 1926 to 1929 by Leyson Brothers, who shipped 10,551 tons of low-grade ore and dump material to the Timber Butte mill at Butte, Mont., where it was treated by selective flotation. From the concentrates produced, 64.46 ounces gold, 179,548 ounces silver, 3,684 pounds copper, 1,006,251 pounds lead, and 2,002,105 pounds zinc were recovered (14).

The Queen Leasing Co. took over the mine in 1940, constructed a 60-ton selective flotation mill, and began operations that continued until March 1942. The mill was dismantled and removed (22-1940). The mine has been idle ever since. Ownership of the property remains with the Quenn Mining & Milling Co., Kalispell, Mont. During operations by the Queen Leasing Co., 23,068 tons of ore and dump material was milled; the metal recovery from concentrates produced therefrom amounted to 27.00 ounces gold, 68,749 ounces silver, 1,188 pounds copper, 400,002 pounds lead, and 81,600 pounds zinc (14).

Ore produced from the Queen of the Hills mine, including that from the O'Brien vein, from 1894 to 1928, inclusive, is reported to have had a value of $437,559.67 (17). No production is recorded for the years 1930 to 1939, inclusive. Production from 1901 to 1942, inclusive, is reported to have been 41,358 tons of ore, from which 130.78 ounces gold, 430,629 ounces silver, 4,872 pounds copper, 2,037,465 pounds lead, and 2,160,105 pounds zinc were recovered (14).

The Queen vein was developed by three adits and a 300-foot shaft with levels at 100 feet and 300 feet (fig. 6). The two upper adits were short. The lower adit was driven northward on the vein to about 400 feet from the end line of the Galt claim, shich adjoins on the northeast. From this point the adit was extended northward by the Galt Mining Co. into the Galt claim and under the higher Galt mine workings. The 300-foot shaft level later was extended northward into the Galt claim. It also was driven southward for a distance of about 650 feet.

The O'Brien vein was developed by an adit drift about 400 feet long driven on this vein from near the northern end of the Queen of the Hills claim. A 300-foot crosscut also was driven westward to the O'Brien vein from a point about 950 feet in from the portal of the Queen adit. An unknown footage of drifting then was done. A vein believed to be the O'Brien was intersected by a crosscut from the 300-foot level of the Queen shaft and drifted on for about 550 feet.

The Queen vein strikes about N. 25° E.; its dip ranges from nearly vertical to 75° SE. The O'Brien vein has about the same strike as the Queen vein but dips about 75° NW. Both veins are in light-colored feldspathic gneiss in the Queen of the Hills claim. In the Galt claim, farther to the north, the Queen vein crosses a rhyolite porphyry dike, then enters Pinto diorite, where it narrows and becomes unproductive (17). On the Queen of the Hills claim, the Queen vein ranged from 1 to 6 feet in width. In places on the Galt claim the vein was 10 feet or more in width.

The sulfide minerals in the ore are chiefly galena, sphalerite, and pyrite, with small amounts of chalcopyrite, pyrargyrite, polybasite or pearceite, and proustite. The Gangue minerals are quartz, ankerite, and barite. In the oxidized upper parts of the veins, limonite, secondary silica, cerussite, smithsonite, native silver, and possibly cerargyrite, were present (17). Unsorted ore shipped during 1926-29 contained an avwrage of about 17 ounces silver a ton, 4.7 percent lead, and 9.6 percent zinc (14).

According to Sam Williams, Belt, Mont., Warren Ford, Raynesford, Mont., and Paul Stark and W. G. Powers, Neihart, Mont., the Queen vein at the 300-foot shaft level was as wide or wider than in the upper parts of the mine but contained more zinc.

When visited in 1949, the upper adits were caved. The shaft apparently was in good condition but filled with water to about 75 feet below the collar. All workings on the O'Brien vein were inaccessible.

Galt (Ag-Pb-Zn)

The Galt mine is east of the main highway about one-eighth mile north of the north end of the main street of Neihart. It adjoins the Queen of the Hills mine on the north. The property first was located as the Massachusetts on January 1, 1886, by Edwin W. Toole, et al. Before the railroad was built to Neihart, the ore mined was dragged down the mountainside in deer skins, transported to White Sulphur Springs by pack horses, hauled by wagon to Livingston, and then sent to Omaha or Kansas City Smelters by rail. The mine was operated intermittently for many years by the Galt Mining Co. In 1895 an agreement was made with the Queen Mining & Milling Co., which gave the Galt Mining Co. the right to extend the main Queen adit for a distance of 400 feet and to use this adit for developing the Galt vein. All ore taken from the Queen vein became the property of the Queen Mining & Milling Co. The Galt Mining Co. agreed to pay $1.25 a ton for all ore mined from the Galt vein and trammed out through the Queen adit. This agreement was for a 3-year period but later was extended from time to time, the royalty rate being reduced to $0.50 a ton.

The mine was idle from 1897 to 1899 (29). It was operated during 1900 and 1901 but again was idle in 1902-1905 (3). Considerable ore was mined from 1906 to 1908 (24). The mine was closed from 1908 to 1916 (14). From 1916 until 1929 it again was in continuous operation. In 1932 the Galt Mining Co. was taken over by the Ford interests of Boston, Mass. The company was reorganized in 1935 as the Galt Mines, Inc. After 1935 the mine was operated by the Lexington Mining Co., then by William Derringer of Great Falls, Mont., and finally by Stark and Rives, who purchased the Galt and Equator claims. To avoid payment for the right to tram ore through the Queen adit, a crosscut was driven to the Galt workings from the Equator claim. During the summer of 1949, the lower Galt adit was being reopened. Ore recovered from this level was treated in the Star Mining Co.'s flotation mill until operations ceased in August. The Galt mine now is owned by L. B. Stark, Neihart, Mont.

The mine is developed by two upper adits, by the extension of the main Queen of the Hills adit, by the extension of the 300-foot drift driven from the Queen shaft, and by a crosscut adit from the Equator claim. Several intermediate levels between the Queen adit and the lower Galt adit also have been driven in the main ore shoot. Other working levels have been driven between the 300-foot level of the Queen shaft and the main Queen adit (fig. 6). When visited in 1949, a part of the lower of the two adits had been rehabilitated and was accessible for a distance of a few hundred feet. All other workings were closed by caving.

According to Warren Ford, Raynesford, Mont., the Galt mine was the first mine to be operated successfully in the Neihart area. Up to 1920 the mine had produced over 800,000 ounces of silver valued at $552,000; about $100,000 in dividends had been paid. In a letter written by Frank Marion in 1920, it was stated that the ore was very rich in many places. At one place the vein was 16 feet wide and averaged 70 ounces silver a ton. Several small carloads of ore netted from $3,600 to $5,327 a carload. In 1928 Jesse L. Maury estimated total production to have been about $1,000,000 (17).

It is known that a large production was made before 1901, but no records are available. Production from 1901 to 1948, inclusive, is reported to have been 20,961 tons of ore, from which were recovered 145.22 ounces gold, 476,584 ounces silver, 5,010 pounds copper, 1,798,223 pounds lead, and 706,927 pounds zinc (14).

The Galt vein occurs mainly in light-colored feldspathic gneiss, but near the north end of the claim it is in Pinto diorite and black amphibolite gneiss. At several places the vein follows along a rhyolite porphyry dike. It ranges from 1 foot to as much as 20 feet in width. Its general strike is N. 20° to 30° E. Where most productive, the vein stands nearly vertical; in the lower levels the dip ranges from 70° to 80° SE. The wall rocks generally are altered for considerable distances from the vein (29). The vein material is mainly crushed altered country rock containing bands or lenses of sulfide minerals. These sulfide minerals are chiefly galena, sphalerite, and pyrite with which polybasite, pearceite, proustite, and pyrargyrite are intimately associated. Carbonates and oxides were of common occurrence in the near surface workings. Other than altered country rock, the principal gangue minerals are quartz, ankerite, and barite. The vein splits along both sides at numerous places; these splits generally were very productive at and near the main vein. Sampling of the ore body at a depth of 950 feet below the surface in 1928 by Jesse L. Maury indicated an average of 19.8 ounces silver a ton, 4.5 percent lead, and 4.5 percent zinc (17).

Star (Ag-Pb.-Zn)

The Star mine is on the east side of belt Creek about half a mile north of the north end of the main street of Neihart. The present Star mine holdings are a consolidation of the Evening Star and London properties. The London vein was discovered and prospected by shallow surface workings and by two adits during the early mining days. Considerable amounts of shipping-grade argentiferous lead carbonate ores were produced from the shallow workings. Later, the main Star adit was driven to develop the southerly extension of the London vein. Several small ore shoots were encountered and mined. The high zinc content of the ore shipped caused the imposition of heavy penalties by the smelter. This discouraged further development; operations ceased. From 1906 to 1915 lessees shipped small amounts of ore. After 1915 small tonnages were mined annually until 1922. After 11 years of inactivity, lesses again began operations in both the Evening Star and London claims; intermittent shipments were made until 1939. In that year Mrs. Loretta Rives of Conrad, Mont., became the owner of the properties. A 50-ton bulk flotation mill was constructed. From 1940 to 1948 the properties were operated by Mrs. Rives, by the Loretta Rives Syndicate, and by the Star Mining Co., which was owned equally by Mrs. Rives and L. B. Stark of Neihart, Mont. About 1944 the mill was remodeled for selective flotation. Ore from the Star mine and from the Galt and Equator claims, which had been acquired by the Star Mining Co., was milled. After Mrs. Rives' death in 1949, Stark purchased the Rives interests.

Production records for the years prior to 1901 are not available. From 1901 to 1936, inclusive, the recorded production from the London group is reported to have been 618 tons of ore, from which were recovered 74.35 ounces gold, 28,421 ounces silver, 233 pounds copper, and 137,717 pounds lead (14). Ore production from the present Star group of claims from 1901 to 1948, inclusive, which includes ore produced from the London claim during 1941-48 and also from the Galt and Equator claims during 1944-47, is reported to have been 54,610 tons. Metal recovery from this tonnage amounted to 626.90 ounces gold, 216,197 ounces silver, 9,428 pounds copper, 1,948,841 pounds lead, and 552,377 pounds zinc (14).

The Star mine is developed by three adit drifts, numerous raises, and three short winzes. Two of the adits are on the London claim. The Star adit, 2,218 feet long, is at an altitude of 5,600 feet, or 134 feet below the lower London adit; it is the main haulage and working level. Two ore shoots were found on this level. One of these, encountered about 240 feet from the portal, was about 125 feet long; the other was farther north under the lower adit of the London claim. It is reported that lead-zinc ore was encountered still farther north when the Star Mining Co. extended the main adit (17). Three winzes were sunk below the Star adit, but no mining has been done below the adit level. One of the winzes about 330 feet in from the adit portal was sunk to a depth of about 60 feet; another winze sunk in the vein below the London ore shoot was about 20 feet deep (17). The depth of the third winze is not known.

The Bureau of Mines conducted a small amount of development and exploratory work on the property in 1944. An old crosscut about 25 feet long, driven northwest from a point about 1,000 feet in from the portal of the Star adit, was advanced an additional 140 feet by the Bureau of Mines. A strong vein having approximately the same strike and dip as the Star vein was encountered 145 feet in from the junction of the crosscut and the main adit.

Where intersected by the crosscut, the vein was 5.5 feet wide but was weakly mineralized. A 6-inch band of quartz and gouge near the center of the vein contained small amounts of lead and zinc sulfides. A horizontal diamond drill hole then was drilled N. 46°31'W. for a distance of 700 feet beyond the face of the crosscut. A narrow vein was cut between 39.5 and 41.5 feet from the collar of the hole. Another vein in bleached diorite was cut between 462 and 466 feet. Sulfide minerals were present in the core and sludge, but analyses showed tham to be generally low in metal content (7).

The Star vein is in a strong, persistent, sheeted fissure that cuts mainly granite gneiss in the Evening Star and Morning Star claims at the southwest. To the northeast in the London claim it is in Pinto diorite. The vein has a general strike of N. 30° E. and a steep dip to the northwest. Local changes in strike are numerous, especially where changes in formation occur. The London ore shoot, the principal ore body in the mine, was more than 600 feet long as exposed in the Star adit; it has been mined throughout a vertical range of 400 feet. Several shorter ore shoots have produced some ore. Vein widths range from 4 to 17 feet, but the higher-grade ore usually is confined to bands 4 inches to 2 feet in width. The rest of the vein filling is altered gneiss or diorite, gouge, and crushed sulfides. Except where the vein material was exceptionally low grade, the entire width of the vein was mined for mill feed. The vein is offset by several cross faults, generally of small displacement. Strong strike faults, however, crushed and ground the ore (7).

Ore mined in the earlier days from the surface and shallow underground workings was shipped to the smelter; it contained lead carbonate with a high silver content. With increased depth the ore became complex, consisting of galena, sphalerite, chalcopyrite, pyrite, stephanite, pyargyrite, and some native silver. Ore mined in recent years was relatively low grade.

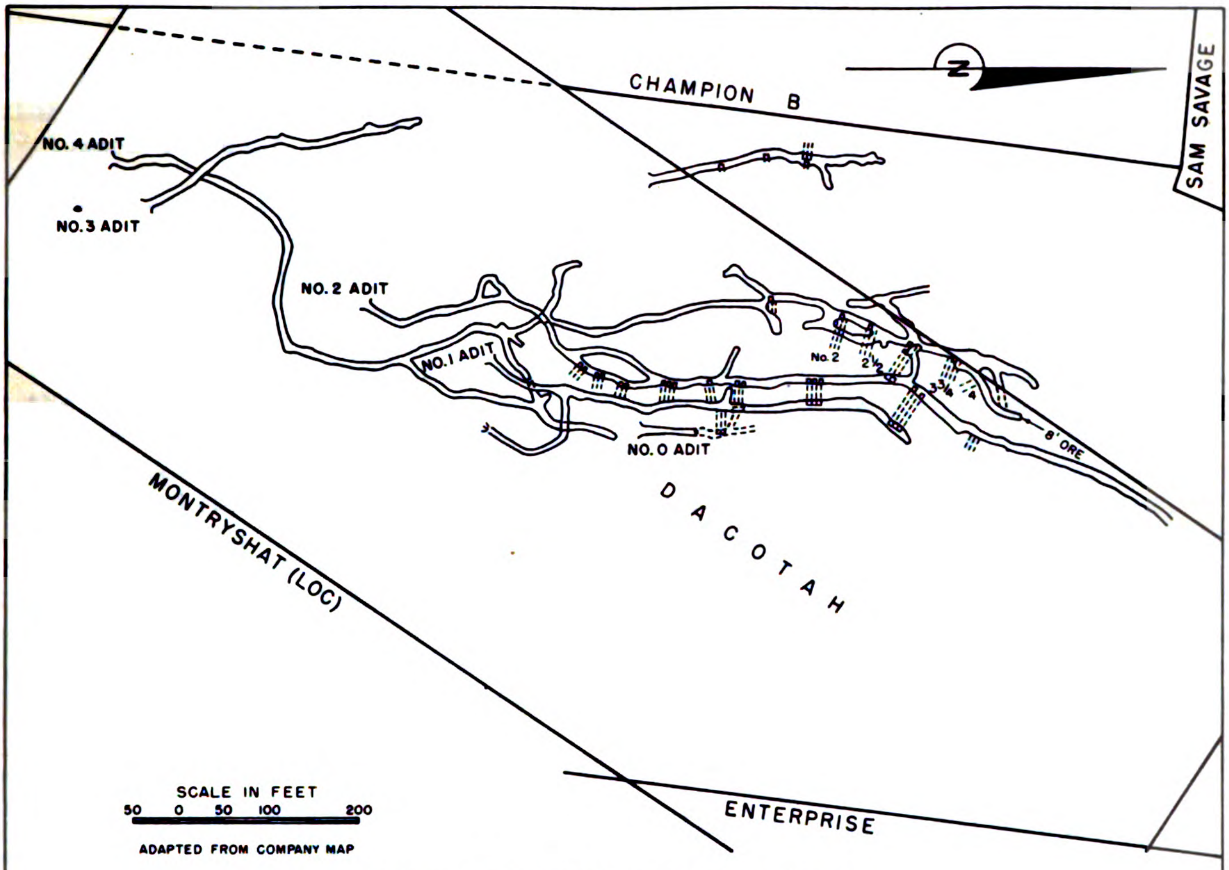
The Star mine has been inactive since about 1945. The Star mill, however, continued to mill ore and gob material obtained from the nearby Galt and Equator mines. When visited in 1949, mill operation was suspended temporarily; the main Star adit was inaccessible owing to a cave at the portal. The upper adits also were closed by caving.

Equator (Pb-Zn-Ag)

The Equator mine is south of the Galt mine and a few hundred feet east of the north end of the main street of Neihart.

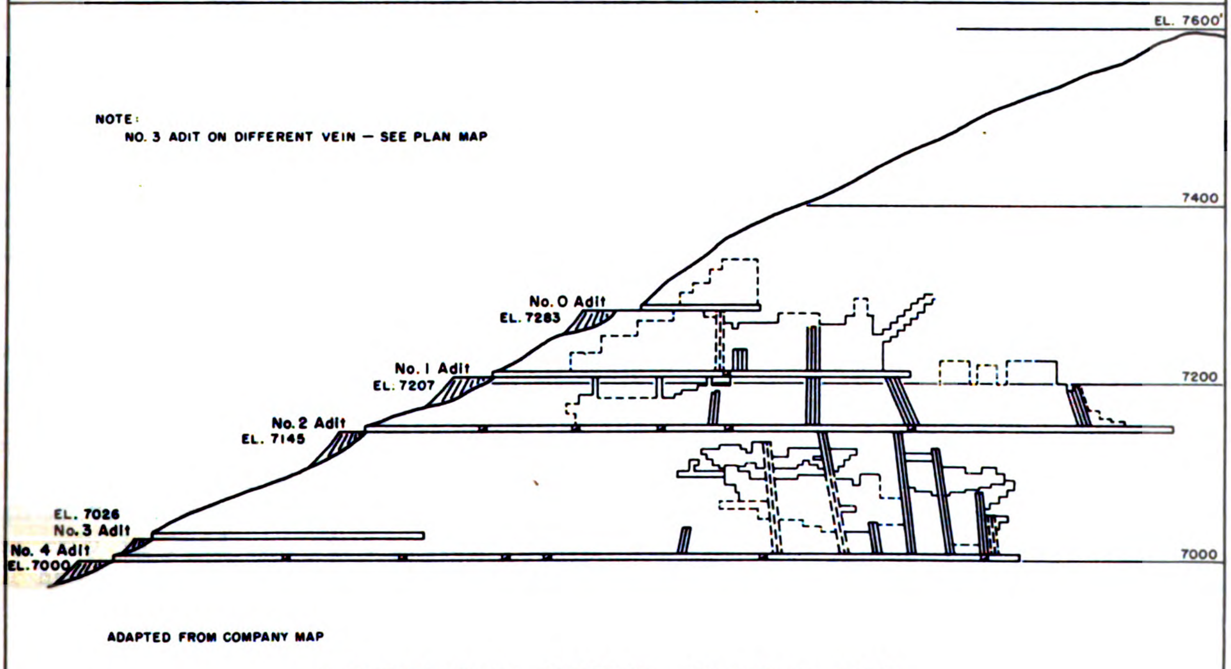
The claim was located December 31, 1887, by Martin Barrett, et al. Little could be learned of its early history. About 1918 it was purchased by the Galt Mining Co. to provide a site for an adit that was to be driven under the Galt upper workings. This proposed work was not done until many years later when both the Galt and Equator claims were acquired by Rives and Stark. These claims now are owned by L. B. Stark, Neihart, Mont.

The vein on the Equator claim was developed by an adit drift driven northward to the old Galt workings. A parallel vein about 25 feet west of the main vein was intersected by a crosscut and drifted on. When visited in 1949, ore was being stoped from both the main vein and the parallel vein. Both



ADAPTED FROM COMPANY MAP

PLAN OF LEVELS, DACOTAH MINE



NOTE:
NO. 3 ADIT ON DIFFERENT VEIN — SEE PLAN MAP

ADAPTED FROM COMPANY MAP

LONGITUDINAL SECTION, DACOTAH MINE

Figure 7. - Plan and longitudinal section, Dacotah mine, Montana district, Cascade County, Mont.

veins are norrow, ranging up to 2-1/2 feet in width; they traverse a light-colored gneiss. The main vein is nearly vertical; the west vein dips about 75° toward the east. Both veins strike about N. 15° E.

Production records for the Equator mine prior to 1915 are not available. Production from 1915 to 1917, inclusive, is reported to have been 364 tons of ore, from which 12.08 ounces gold, 13,367 ounces silver, and 273,309 pounds lead were recovered (14).

The Equator mine has been operated on a relatively small scale since 1944 by the Star Mining Co., the ore being milled in that company's 50-ton selective flotation plant. In the spring of 1949, most of the Star Mining Co. production was made from Equator ore and gob material from the Galt mine. This combined mill feed is reported to have averaged about 5 ounces silver, 2.7 percent lead, and 2 percent zinc. Production from the Equator mine during recent years has not been recorded separately but has been included in the production of the Star Mining Co.

When visisted in 1949, the Equator adit was open and in good condition for a distance of about 1,300 feet.

Dacotah (Ag-Pb-Zn)

The Dacotah mine (fig. 7) is about 1 mile northeast of Neihart at the head of Rock Creek. It was located in 1883 by the father of the present owners. The property holdings, consisting of three patented claims and one unpatented claim, first were prospected by shallow surface workings and two short adits. It was leased to the Neihart Mining Co. in 1891 and operated intermittently by that company for several years (9). When visisted by Weed (29) in 1897, the mine was idle. At that time the main adit was closed by a cave about 300 feet in from the portal.

The mine was operated in 1911 and 1912 by Charles Whitcomb & Co. (26). It was idle again until about 1924, when it was reopened, and some mining was done until 1926 (22-1926). The mine then remained closed until 1942, when Carrol Bennett organized the Bennett Mining Co. A development loan was obtained from the Reconstruction Finance Corporation. The old Florence mill, acquired from the M & I Mining Co., was remodeled for selective flotation to treat about 60 tons of ore a day. Mine and mill were operated continuously until the latter part of 1945. During this period about 2,000 tons of zinc concentrate and about 800 tons of lead concentrate were shipped. Revenue from these shipments was sufficient to repay the R.F.C. loan and also realize a profit. The mine was reopened in 1946 and operated until May 1949, when the drop in lead and zinc prices caused suspension of mining and milling. All holdings of the Bennett Mining Co. are owned by Carroll R. Bennett, Mrs. Frances A. Clarke, and Josephine A. Bennett, all residing at Great Falls, Mont.

No production records previous to 1924 are available. During 1924-26 production is reported to have been 456 tons of ore, from which were recovered 6.42 ounces gold, 3,433 ounces silver, 148 pounds copper, 70,757 pounds lead, and 93,489 pounds zinc (14).

Production records from 1942-49 are not available for publication. Such records as are available indicate the production during this period to have been more than 1,000,000 pounds of lead, nearly 3,000,000 pounds of zinc, appreciable amounts of silver, and some copper and gold.

The Dacotah vein has been developed by four adits ranging from 100 to more than 1,200 feet in length (fig. 7). Two other adits about 300 feet and 260 feet long were driven on two other veins, from which some ore was mined during the early days.

According to an unpublished Bureau of Mines report, the Dacotah vein, in the central part of the Dacotah claim, follows a strong well-defined fissure in light-colored gneiss. As it continues northeasterly it enters Pinto diorite, where it tightens and narrows for a considerable distance, particularly along the No. 4 adit level. The strike of the vein in the gneiss is alsmost due north; it ranges from N. 20° E. to N. 40° E. in the Pinto diorite. The average dip is about 60° to the west. The Dacotah vein ranges from 2 to 8 feet in width. The vein material is mainly crushed altered country rock containing galena, sphalerite, pyrite, and silver sulfides in bands and disseminations.

Mine-run ore milled in 1949 contained zinc and lead in a ratio of about 2.5:1. The zinc concentrate produced averaged about 52 percent zinc, 3 to 4 percent lead, 0.5 ounce gold, and about 7 ounces silver a ton. The lead concentrate contained an average of about 55 percent lead, 6 to 9 percent zinc, 0.2 ounce gold, and 20 ounces silver.

Development in recent years from the north end of the No. 4 adit encountered a rich wide ore shoot which, however, was not opened before the mine closed. Good ore was developed on the No. 2 adit 145 feet above and about 200 feet farther to the north of the face of the No. 4 adit. Bulldozer trenching on the surface exposed the vein to the north of the mine workings.

The vein has had little development above the No. 1 adit level, although some stoping has been done from that level and the No. 0 adit level (fig. 7). The Dacotah ore shoot as developed and mined rakes about 35° N. Indications are that ore may continue northward for a considerable distance beyond the present faces of the No. 2 and No. 4 adits. Development below the No. 4 adit level would require sinking from that level or the driving of a long adit at a lower altitude.

When visited in 1949, mine and mill operations had suspended. The No. 2 and No. 4 adit workings apparently were in good condition but were tightly barricaded so that access was impossible.

Silver Belt (Ag-Pb-Zn)

The Silver Belt mine is about 3,000 feet north of the Broadwater mine and about 1 mile northeast of the town of Neihart. It is at a high altitude on the west slope of Neihart Baldy Mountain.

The claim was located September 7, 1888, by James L. Neihart. It was purchased from Neihart by D. L. S. Barker, et al, in 1900 (3). Barker operated the mine until 1919, when it was sold to the Neihart Silver Mines Co., Neihart, Mont. (17). This company, which still owns the property, operated it intermittently until 1927. The mine was not worked again until 1935. From 1935 until 1938 the mine was worked through the Broadwater mine, from which workings had been extended through the Black Bird claim and north along the vein under the old Silver Belt workings. Since 1939 only a small amount of ore has been mined by lessees.

Production records for years previous to 1900 are not available. Net smelter returns for ore shipped between 1900 and 1927 are reported to have aggregated $212,920.12 (17). Production from 1902 to 1941, inclusive, is reported to have been 62,175 tons of ore, from which were recovered 585.59 ounces gold, 449,610 ounces silver, 1,183 pounds copper, 663,607 pounds lead, and 46,970 pounds zinc (14).

The vein first was explored by a shallow shaft sunk on the vein. Later, a 425-foot crosscut adit was driven to the vein. Ore was mined above that level from a drift. A 100-foot winze then was sunk from this adit level. An ore shoot, encountered 15 or 20 feet south of the winze, was mined to the adit level. Three shoots of ore north of the winze also were mined (17). The downward extensions of these shoots probably were mined later from the upper workings of the Broadwater mine. The vein on the Silver Belt claim was considered to be either the main Broadwater vein or a branch from it. It traverses Pinto diorite near its contact with gneiss. According to Paul Vdovic, Neihart, Mont., the vein split into narrow stringers near the central part of the claim. Its general strike was about N. 10° to 20° W. The dip was nearly vertical, or steeply to the west.

Although the vein was narrower in the Pinto diorite than in the gneiss, it contained very rich silver ore. Early shipments are reported to have contained 20 to 300 ounces silver, 2 to 20 percent lead, 4 to 30 percent zinc, and 0.02 to 0.80 ounce gold a ton. Secondary enrichment of the vein from 100 to 150 feet below the surface probably was responsible for the large silver content of the ore mined to that depth (17).

When visited in 1949, the old upper workings were covered with slide rock. The main adit was closed by a cave at the portal.

Black Bird (Ag-Pb-Zn)

The Black Bird claim contains the northward extension of the Broadwater vein. It is about three-fourths of a mile east of Neihart, one-fourth mile north of the Broadwater mine, and one-eighth mile east of the Hartley mine.

The claim was located August 20, 1890, by Homer Thomas. It was worked intermittently by the owners and lessees before 1923. It now is owned by Neihart Silver Mines Co., Neihart, Mont.

Most of the production was made between 1915 and 1922 when mined through the upper workings of the Broadwater mine. Net smelter returns to 1935 are reported to have been $33,960.40 (17). Production data for years previous to 1915 are not available. Production from 1915 to 1921, inclusive, is reported to have been 539 tons of ore, from which 66.01 ounces gold, 46,760 ounces silver, and 71,489 pounds lead were recovered (14).

First development consisted of a shallow shaft and open pits. Later, a crosscut adit was driven S. 45° W. This adit, about 185 feet long, was driven through hard Pinto diorite for about 110 feet, then into silicified, altered gneiss. A narrow vein was intersected at about 125 feet. The main vein was intersected about 50 feet beyond. Drifts were driven northward and southward on both veins. A short crosscut was driven east from the north drift on the main vein. A third vein was intersected by this crosscut. All three veins were stoped irregularly above this adit level. A raise from one of the upper levels of the Broadwater mine was driven to the main drift. All of the veins are narrow quartz-filled fissures ranging from half an inch to 2 feet in width. Sooty silver sulfides, galena, sphalerite, and pyrite occur in and alongside the quartz.

A Bureau of Mines sample chipped from a 1-inch quartz band showing in the back of the first drift at a point about 125 feet north of the crosscut assayed 10.8 percent lead, 14 percent zinc, 53.3 ounces silver, and 0.05 ounce gold.

When visited in 1949, the main crosscut adit and the north drifts were open and in good condition. The south drifts were blocked by caving about 100 feet south of the crosscut. The old surface pits were covered with slide rock.

Spotted Horse (Au-Ag)

The Spotted Horse claim is at a high altitude on the west slope of Long Baldy Mountain, about 2-1/2 miles southeast of Neihart. It was located in the early days, but little could be learned of its history. The claim now is owned by J. J. Stewart, Spokane, Wash., Howard A. Murray, Annie H. Maury, and Verna E. Shone, each holding a one-quarter interest. No production data are available, but it is known some ore has been shipped from the property.

The underground development consists of a crosscut adit about 120 feet long and a drift driven southward from the end of the crosscut for several hundred feet.

The vein ranges from a few inches to about 3 feet in width. It strikes N. 15° to 20° E. and stands nearly vertical. It traverses Pinto diorite and gneiss. Both walls of the vein are highly altered and kaolinized. The vein material is mainly altered diorite or gneiss with a narrow stringer of quartz. Pyrite is disseminated in the vein material and in some places occurs in small masses along the walls. No silver, lead, or zinc minerals are in evidence.

A Bureau of Mines sample of sacked ore found in a small cabin near the adit portal assayed 1.02 ounces gold, 44.4 ounces silver, less than 0.05 percent lead, and less than 0.1 percent zinc.

When visited in 1949, the crosscut adit was in good condition. The drift was accessible but in poor condition for about 200 feet, where it was blocked by a cave.

Broken Hill (Ag-Pb)

The Broken Hill mine is on the west slope of Neihart Baldy Mountain, a short distance east of the Broadwater mine. The claim was located in the 1880's, but little could be learned of its early history or development. The mine was operated by lessees from 1906 to 1911 and again from 1919 to 1921. Production records prior to 1906 are not available. Production from 1906 to 1921, inclusive, is reported to have been 769 tons of ore, from which were recovered 0.57 ounce gold, 42,778 ounces silver, and 72,454 pounds lead (14).

The vein traverses gneiss, which in the near vicinity is overlain by Neihart quartzite. It is similar in character but narrower than the Broadwater vein. Underground workings now are inaccessible.

Fairplay (Ag-Pb-Zn)

Fairplay claim is on the crest of the divide between Snow Creek and Belt Creek, about 1-1/8 miles northeast of Neihart. It adjoins the Silver Belt claim at the north. The claim was located in the 1880's. No information regarding its early history or development is available. The present owner is Belle L. Templeman, Butte, Mont.

Production data previous to 1919 are not available. Production in 1919 to 1926, inclusive, is reported to have been 125 tons or ore, from which were recovered 15.98 ounces gold, 5,098 ounces silver, 28,030 pounds lead, and 21,002 pounds zinc (14). Zinc recovery was made only from a 57-ton ore shipment in 1926. In addition to the zinc, this 57-ton shipment yeilded 3.39 ounces gold, 1,125 ounces silver, and 15,575 pounds lead.

According to Paul Vdovic, Neihart, Mont., the vein is a narrow filled fissure in Pinto diorite. It has been developed by a short adit. The ore contains galena, sphalerite, pyrite, silver sulfides, considerable cerussite, and limonite.

Ingersoll (Ag-Pb-Zn)

The Ingersoll claim is one of a group of five claims adjoining the Moulton group on the north. The claims are on Rock Creek and extend up the side of the main ridge about one-half mile northeast of the north end of the main street of Neihart. They are owned by Vesta R. Pierse, Los Angeles, Calif.

The Ingersoll claim was located June 6, 1888, by Stephen Pierse. Development was begun soon after location. In 1891 and 1892 considerable drifting was done. The main drift adit later was lengthened to 1,100 feet, and a 75-foot crosscut was driven to the west from a point near the face of the adit. A 112-foot raise was driven at a point 400 feet in from the adit portal. A drift from the top of the raise was driven to the surface (9). This upper drift later was extended northward for about 150 feet and exposed a short ore shoot. The west crosscut from the main adit was later advanced 600 feet to the Queen of the Mountains vein. Drifts were driven on this vein both northward and southward. The south drift extended to the Gem, or South Carolina, claim, which adjoins the Moulton claim at the north (17). About $45,000 was expended in development up to 1897, but only six carloads of sorted ore were shipped, the last carload netting only $200 (29).

Gold values in the sorted ore shipped were somewhat higher than in ore from other nearby mines. One shipment yielded $15 gold and 10 ounces silver a ton (17). Production records for years previous to 1904 are not available. Production from 1904 to 1917, inclusive, is reported to have been 107 tons of sorted ore, from which 11.87 ounces gold, 4,387 ounces silver, and 27,938 pounds lead were recovered (14).

The Ingersoll vein occurs in gneiss, Pinto diorite, and minette; it is reported to have been generally narrow and low-grade. It strikes N. 10° to 20° E. At the southern end the dip is to the west; at the north the dip ranges 60° to 80° SE. The Ingersoll vein contained a narrow band of spar dotted with galena, sphalertie, pyrite, and small amounts of silver sulfides; it averagedless than 6 ounces silver a ton (29). However, it contained some small higher-grade steaks. Another vein 2 feet in width, which was cut by the west crosscut about 150 feet from the main vein, contained bunches of ore but averaged low in silver (29).

The main Ingersoll vein may be the northward extension of the Moulton vein or a split from it, or it may be the northward extension of one of the veins cut by the Rochester adit on the Unity claim of the Moulton group. The downward extensions of the Ingersoll veins and the Gem-Queen of the Mountains vein might be developed at a considerably lower altitude by extending the Compromise adit northward through the Moulton fault and under the old Ingersoll workings. The veins also might be developed at a much greater depth by extending the 300 shaft level of the Moulton mine northward under the Ingersoll claim and then crosscutting.

When visited in 1949, both adits on the Ingersoll claim were inaccessible.

Rock Creek (Ag-Pb-Zn)

The Rock Creek claim adjoins the Ingersoll claim at the east and the Lizzie claim at the south. It was located August 27, 1888, by Patrick Boyle. The claim was purchased later for R. E. Paine, 50 Congress Street, Boston, Mass. It now is owned by Paine's heirs, for whom H. L. Maury, Butte, Mont., is agent.

The claim was worked extensively in the 1890's. A small amount of ore was produced, but no production records are available. Several veins were exposed by crosscuts and drifts east from the main adit, which followed the main vein for several hundred feet (17). The main vein is 1 to 3 feet wide; it strikes N. 10° W. and dips 45° to 70° SW. One ore shoot about 80 feet

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long was found about 200 feet in from the main adit portal. According to Jesse L. Maury, who examined the mine in 1929, the ore in this shoot averages 38 inches in width. It contains an average of 2 ounces silver a ton, 2.6 percent lead, and 3.9 percent zinc. The other veins, explored from crosscuts driven east from the main adit, failed to disclose ore of commercial grade. These veins have strikes ranging from N. 15° E. to N. 45° E.; they dip 70° to 90° NW. Ore mined from the shoots on the main vein, after careful sorting, is reported to have yielded 80 ounces or more of silver a ton and 16 to 18 percent lead (17). The veins traverse gneiss, Pinto diorite, and amphibolite, in some places following along the diorite-gneiss contact. The main adit was inaccessible when visited in 1949 owing to caving at the portal.

Lizzie (Ag-Pb-Zn)

The Lizzie claim is near the head of Rock Creek about three-fourths of a mile east of the north end of the main street of the town of Neihart.

The claim was located August 31, 1881, by Michael Powers, one of the first discoverers of veins in the Neihart area. It still is owned by Powers' heirs, Mrs. Bertha Powers, Neihart, Mont., one-third; Mrs. H. W. Powers, Conrad, Mont., one-third; and Mrs. John Powers, address unknown, one-third.

Early operations by the owner continued intermittently until 1897. Since then lessees have operated sporadically. The last work on the claim was done in 1943 by W. J. Powers, Neihart, Mont.

Records of production prior to 1907 are not available. According to Weed, the first ore shipped was from the discovery shaft; the 15-ton shipment netted the owner $786. It was estimated that about $5,000 worth of ore had been produced up to 1897 (29). Production from 1907 to 1943, inclusive, is reported to have been 347 tons of ore, from which 17.42 ounces gold, 30,458 ounces silver, 130 pounds copper, and 99,861 pounds lead were recovered (14).

At least four veins occur within the claim. Surface cuts indicate the presence of several other veins. Two of the veins have been developed to shallow depths by six adits. The lower No. 1 adit, near the south end of the claim, is 200 feet long. The No. 2 adit, on a parallel vein, is reported by W. J. Powers to be 350 to 400 feet long. Two short crosscuts were driven east and west from this adit for distances of 15 and 20 feet, respectively. The faces of both crosscuts are in altered vein material. Some low-grade ore occurred in small lenses in this adit.

The No. 3 adit, driven on the same vein but about 145 feet higher, is approximately 100 feet in length. It was started in Pinto diorite 30 feet east of a large mass of red, feldspathic gneiss. A wide vein is reported to have been followed in this adit. The strike of the veins in the No. 2 and No. 3 adits is N. 10° E.; they dip 75° to 80° NW. No. 4 adit, 100 feet above No. 3, is reported to be about 120 feet long. It was driven on a vein about 4-1/2 feet wide containing an oxidized, honeycombed quartz steak about 1 foot in width. A short shoot of ore was found near the portal and was mined to the surface, where it merged with a vein of solid quartz 8 inches wide. A shaft was sunk on this narrow quartz vein to a depth of 20 feet. Both veins are in altered gray gneiss. They strike N. 10° to 15° E. The wider vein dips 75° NW. The 8-inch vein is nearly vertical.

No. 5 adit is reported by Powers to be approximately 100 feet in length. A small amount of ore was found by this adit. It is 35 feet higher than the No. 4 adit and apparently was driven on the same vein. No. 6 adit is 120 feet higher than No. 5. It is about 120 feet long. The vein followed by this adit strikes N. 6° E. and dips 43° to 45° NW. It is in gray altered gneiss for most of the length of the adit, but near the face Pinto diorite occurs on the hanging wall side. A band of quartz about 1 inch wide follows the footwall. A small amount of silver sulfide minerals can be seen in and alongside of this narrow quartz band.

The discovery shaft, now caved, is near the top of the main ridge about 45 feet above and 125 feet north of the No. 6 adit portal. It was sunk on an oxidized quartz vein in gray gneiss. This vein is about 1 foot wide and dips about 75° NW.

Other large cuts and pits about 100 feet to the east indicate where the oxidized outcrops of other veins were prospected. According to Powers, a small amount of high-grade silver ore was mined from these cuts. Most of the ore shipped was mined from the No. 2 and No. 3 adits.

Veins similar to those on the Lizzie claim have been prospected on the Crandall claim adjoining at the north. Some ore was produced from shallow workings. Several veins have been drifted on on the Rock Creek claim adjoining at the south.

When visited in 1949, the No. 4 adit was accessible for a short distance beyond the portal. No. 6 adit was accessible to its face. The other adits were caved at their portals.

Champion "B" (Ag-Pb-Zn)

The Champion "B" claim adjoins the Lizzie claim at the east and the Dacotah claim at the west. It is about 1 mile northeast of Neihart. The claim was located in the 1880's. Little could be learned of its early history. Marvin E. Corkill of White Sulphur Springs, Mont., is the present owner.

Production data for years prior to 1919 are not available. Production from 1919 to 1946, inclusive, is reported to have been 123 tons or ore, from which were recovered 13.76 ounces gold, 4,070 ounces silver, 31,474 pounds lead, and 6,574 pounds zinc (14). One carload, or 24 tons, of this ore was shipped to the Midvale, Utah, concentrator in 1943. From this shipment, 2.00 ounces gold, 415 ounces silver, 6,251 pounds lead, and 5,800 pounds zinc were recovered (14).

Two parallel veins traverse Pinto diorite. From one adit a 30-foot winze is reported to have been sunk on a vein 3 feet wide (17). According to Sam Williams, Belt, Mont., the east vein averaged about 8 or 10 inches in width and dipped steeply to the east toward the Dacotah. The strike of both veins is about the same as those in the Lizzie claim. Vein material on the dump of the middle of three adits indicates the vein was mainly honeycombed quartz containing considerable galena, sphalerite, and pyrite. Limonite, cerussite, and probably smithsonite also may be present. A sample of ore taken from one of the dumps by Jesse L. Maury is reported to have assayed 23.4 ounces silver, 10.1 percent lead, and 6.8 percent zinc (17).

When visited in 1949, all of the adits were inaccessible.

Commonwealth, Spotted, and Lucky Strike (Au-Ag-Pb)

The Commonwealth and Spotted claims are high on the east slope of the ridge between Snow Creek and Rock Creek, about 1-1/2 miles northeast of Neihart. The Commonwealth adjoins the Silver Belt claim at the east. The Spotted adjoins the Commonwealth at the north. The unpatented Lucky Strike claim is north of the Spotted claim.

Little historical information could be obtained. At one time the Commonwealth and Spotted veins were developed by the Red Star Mines Co. In 1935 the Commonwealth and Lucky Strike veins were prospected (17). The Commonwealth and Spotted claims were purchased at tax sale by the present owners, J. J. Steward, Spokane, Wash., and Mrs. Victor G. Leick. Owners of the Lucky Striko claim are unknown.

According to Schafer (17), the Commonwealth vein was developed by two adits, the parallel Lucky Strike vein by one adit. No information is available regarding the development on the Spotted claim. Both veins are in Pinto diorite. They range from a few inches to 2 feet in width, widening locally at intersections or splits. The ore mineral is chiefly galena with small amounts of sphalerite and silver sulfides in a gangue of carbonates and quartz (17).

No data on production previous to 1921 are available. Apparently because of the various lessees and differing leases, production records since 1921 are not available for each claim but have been combined, as follows: Production from the Lucky Strike and Spotted claims, 1921 to 1941, inclusive, is reported to have been 132 tons of ore, from which were recovered 119.61 ounces gold, 9,604 ounces silver, 494 pounds copper, and 2,159 pounds lead (14). Production from the Commonwealth and Spotted claims, 1935 to 1940, inclusive, is reported to have been 74 tons of ore, from which 35.5 ounces gold, 4,322 ounces silver, 114 pounds copper, and 2,429 pounds lead were recovered (14).

The mine workings were inaccessible in 1949.

Cumberland (Ag-Pb-Zn)

The Cumberland claim adjoins the Equator claim at the east; it lies a short distance west of the Moulton claim. The claim was located in the early 1880's by Duncan McCowan; later, it was patented. The Neihart Cumberland Mining Co. (Mrs. Eliza Booth, Great Falls, Mont.) is the present owner.

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Development consists of a 400-foot adit, now inaccessible. The vein occurs in pink gneiss (29). It probably is the same vein from which some silver-lead ore was mined on the Peabody claim, which adjoins the Cumberland claim at the north. Some high-grade ore is reported to have been mined from the Cumberland claim during McCowan's ownership. Later, it was worked at intervals by lessees. Nothing has been done on the claim in recent years.

Peabody (Ag-Pb)

The Peabody claim lies between the Galt claim and the Queen of the Mountains claim. It was located March 26, 1888, by Henry G. Klenze, et al. The property now is owned by O. F. Wadsworth, Jr., c/o Edward Byrnes, Boston, mass.

The Peabody vein is in pink gneiss. It is reported to be the northward extension of a vein on the Cumberland claim, which adjoins at the south.

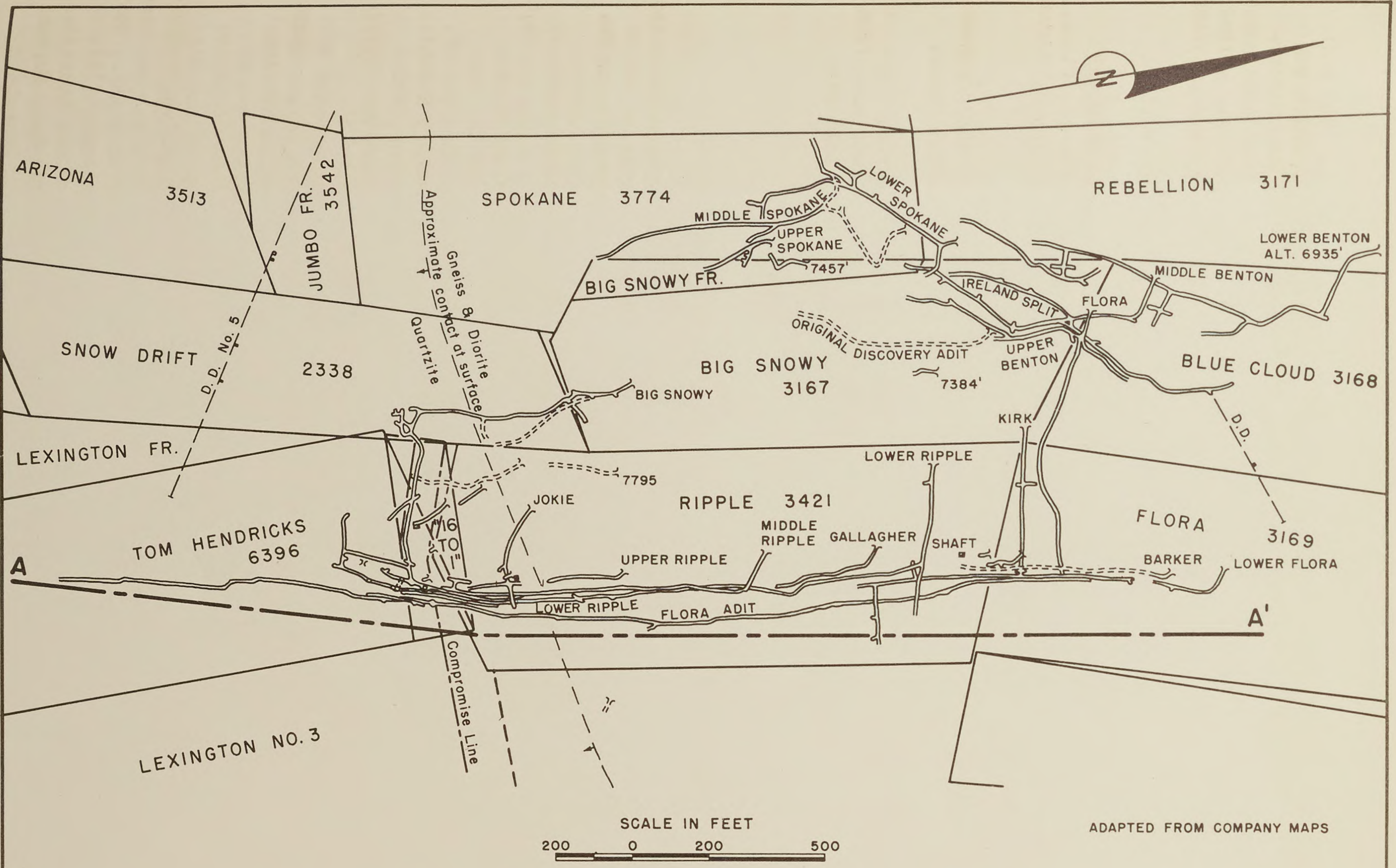
Production data for years previous to 1922 are not available. Production for 1922 to 1940, inclusive, is reported to have been 152 tons of ore, from which 1.0 ounce gold, 10,433 ounces silver, and 26,136 pounds lead were recovered (14).

All mine workings are reported to be inaccessible.

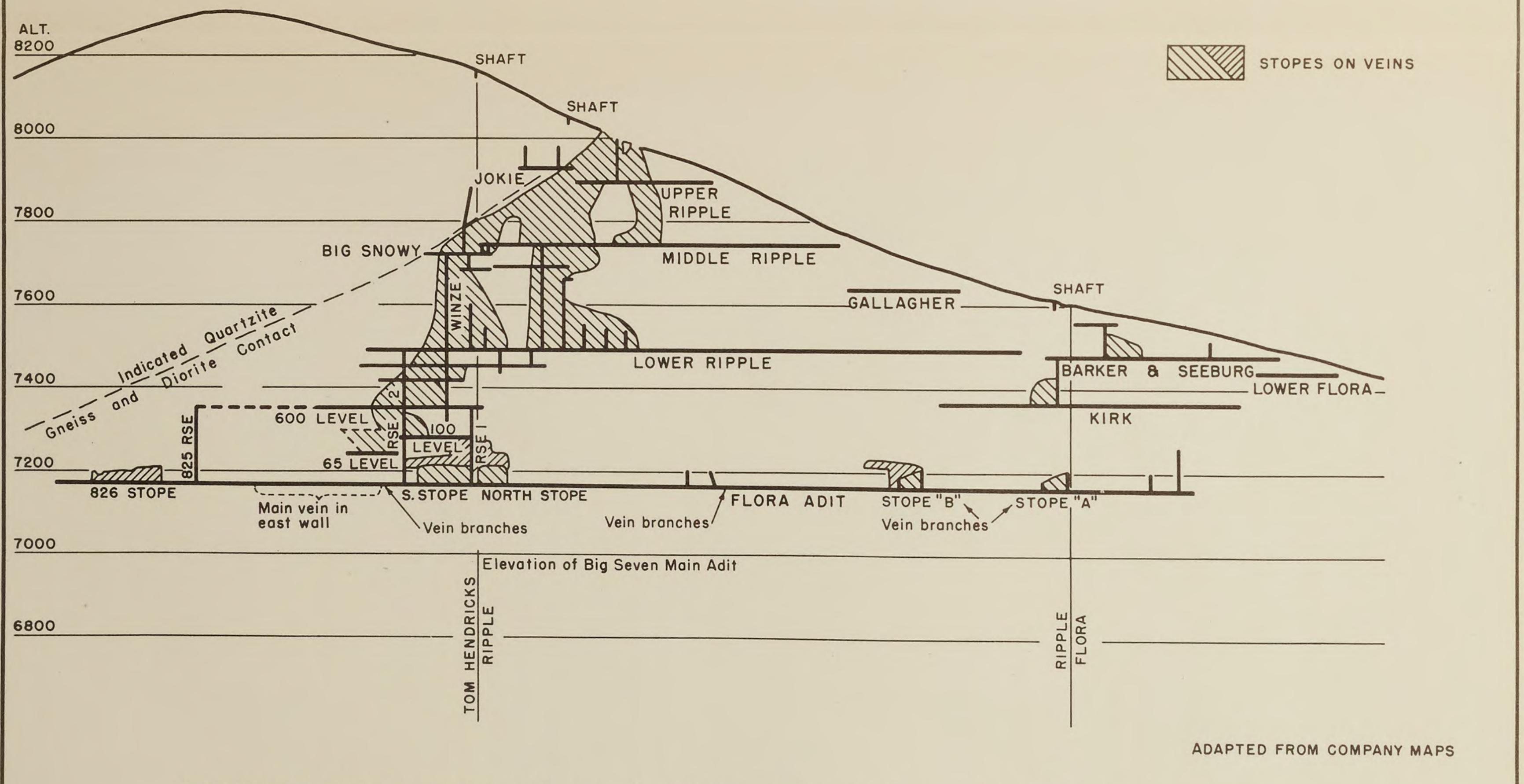
Benton (Ag-Pb-Zn)

The Benton group of 15 patented claims is at the head of Snow Creek about 1-1/2 to 2 miles east of Neihart. The group is comprised mainly of claims located from 1886 to 1890 and later acquired by the Benton Group Mining Co. Ten of the claims, Big Snowy, Big Snowy Fraction, Flora, Spokane, Laura, Last Chance, Blue Cloud, Puck, Loo Loo, and Rebellion, are owned entirely by the company. The Arizona and Union claims are owned by the Spencer, Mayn, and Heitman heirs. Ownership of the other claims is divided; the Benton Group Mining Co. has a 19/30 interest in the Sixteen-to-One and the Tom Hendricks claims and a 1/20 interest in the Snowdrift claim. The Spencer, Mayn, and Heitman heirs own the remaining interests. C. B. Power, Helena, Mont., is president of the Benton Group Mining Co. G. K. Spencer, White Sulphur Springs, Mont., is trustee for the Spencer, Mayn, and Heitman heirs.

First operations on the claims were conducted by their owners and by lessees. The principal workings were at the Big Snowy mine, which was owned and operated in 1891 by the Montana Mining Co. (9). Considerable development was done in 1891 and 1892. The ore mined was shipped to the Helena Sampling Works (10). Veins on the adjoining Blue Cloud and Spokane claims also were developed. The Big Snowy Mining Co. owned and operated the Big Snowy mine in 1900 (3). During several following years, good ore was produced by several different lessees. By 1906 control of most of the claims had been acquared by the Benton Group Mining Co., of which T. C. Power of Helena, Mont., was president (23). All mining since 1906 has been done by lessees (17). Operations were conducted intermittently by Barker Brothers, D. L. Ledbetter, and C. L. Kirk, and in more recent years by the Montana Leasing Co., Montana Silver Queen Mining Co., Lexington Mining Co., and Lexington Silver-Lead Mines, Inc.



PLAN OF BENTON GROUP & RIPPLE MINE WORKINGS



LONGITUDINAL SECTION A-A', FLORA, RIPPLE & TOM HENDRICKS VEINS

Figure 8. - Plan and section, Benton group and Ripple mines, Montana district, Cascade County, Mont.

Records of production for the years prior to 1905 are not available. It is reported that up to 1898 production from the Benton (Big Snowy) mine (fig. 8) had a value of more than $400,000 (29) (17). Production of the Benton group from 1905 to 1948, inclusive, is reported to have been 54,713 tons of ore, from which 1,033.47 ounces gold, 640,935 ounces silver, 9,407 pounds copper, 1,128,733 pounds lead, and 333,357 pounds zinc were recovered (14).

The Big Snowy veins were developed by four main adits ranging in length from about 500 feet to more than 1,600 feet (fig. 8). Another adit at the southern end of the claim was about 600 feet long. From this adit, a crosscut was driven through the Sixteen-to-One claim to the vein that traverses the Tom Hendricks, Ripple, and Flora claims. Several adits also were driven on the Spokane, Blue Cloud, and Flora claims, where development, including raises and winzes, totals several thousand feet.

According to Weed (29), the vein developed in the upper Big Snowy adit traversed both Pinto diorite and quartzose gneiss. In places the vein followed the contact of these formations. The vein material was a bluish, decomposed, brecciated gneiss. The walls were soft and highly altered. The ore minerals in the upper adit were confined mainly to a narrow band or streak consisting of loosely compacted sulfides with native silver, usually only a few inches wide but very rich. In the lower or main adit the vein was 3 to 6 feet wide but narrowed appreciably in the diorite. In the lower adit the ore occurred mainly in bunches or small lenses (29)(17). The ore was highly siliceous; it contained abundant pyrite, with galena, sphalerite, silver sulfides, and some gold. Galena and sphalerite increased at depth (17).

The gold content of the ore was higher than that in the ores from most of the mines in the Neihart district. For this reason the mine was profitably operated from 1892 to 1896 despite the low prices of silver and lead (29).

For several years a gravity-type mill was operated at the property. The mill was dismantled many years ago. In later years most of the ore was milled in the nearby Lexington 150-ton flotation plant.

The Lexington Silver-Lead Mines, Inc., mined a part of the Tom Hendricks vein through the Big Snowy adit and treated material from the Big Snowy dump. This company ceased operating in April 1948. The Benton group has been inactive since that time. When visited in 1949, most of the old adits were caved or otherwise inaccessible.

Big Seven (Ag-Pb-Zn)

The Big Seven mine is in upper Snow Creek Valley about 2 miles northeast of Neihart. The mine workings are mainly on the Emmett, Silver Horn, Red Horse, Jennie Whipple, and Longview claims, which are part of a group of 11 patented and 2 unpatented claims known as the Big Seven group. These claims are to the west of the Benton Group Mining Co. claims.

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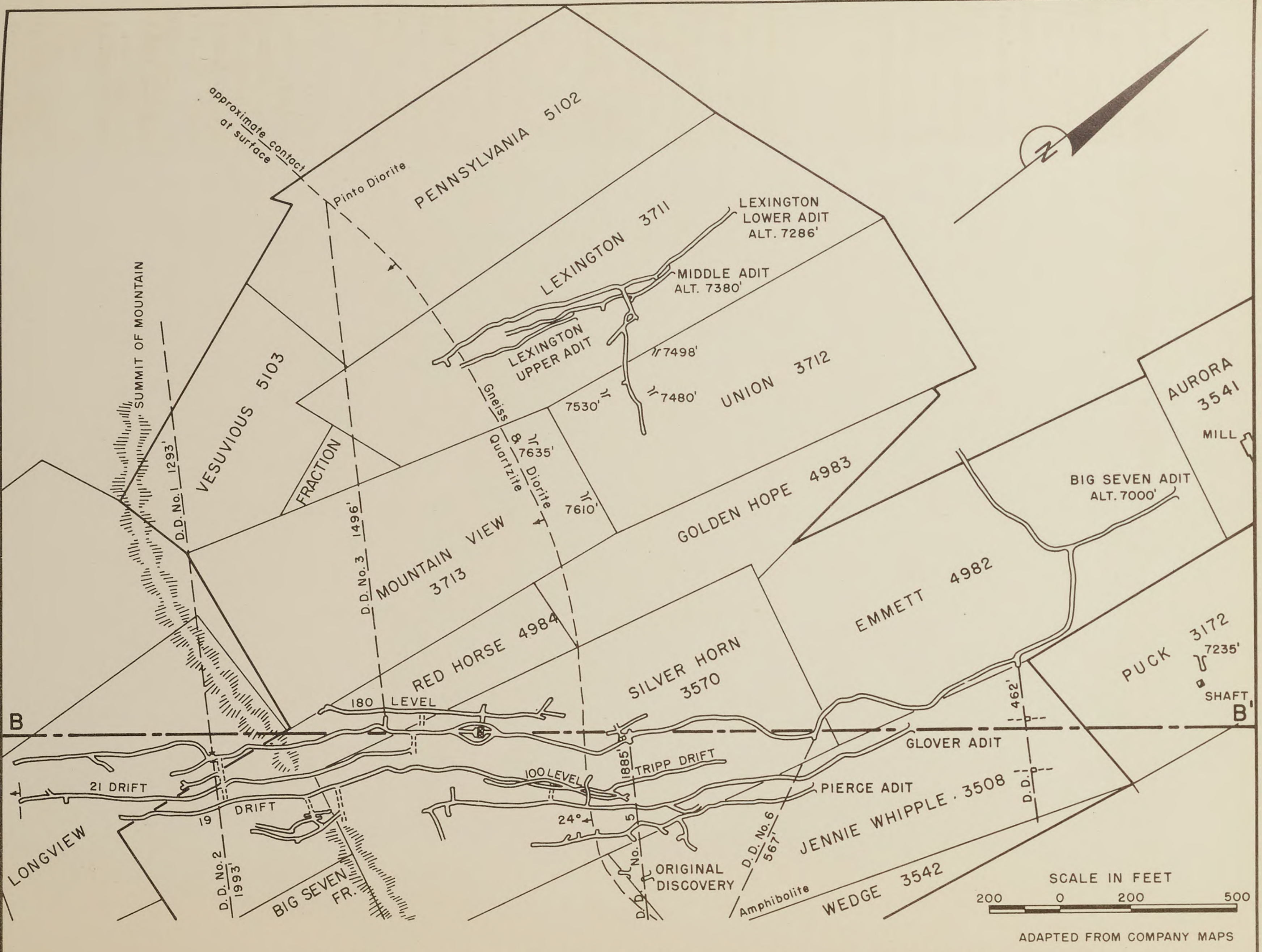
Most of the claims were located in the early 1890's. The Emmett was located January 1, 1891, by the Big Seven Mining Co., which operated the mine for several years. It was operated later by D. L. S. Barker and by the Montana Silver Queen Mining Co. This company, incorporated in 1935, changed its name and combined with the Lexington Mining Co. in June 1940 (22-1940). The Lexington Mining Co. operated the Big Seven mine until July 1943 and remodeled and enlarged the 100-ton bulk flotation mill, formerly constructed and operated by the Montana Silver Queen Mining Co., to a 150-ton selective flotation plant. The mine and mill then were leased to the Montana Leasing Co. Operations under this leasing company continued until December 1, 1946, when the Lexington Silver-Lead Mines, Inc., acquired control of the Big Seven group of claims and the mill (26). This company, with offices in Spokane, Wash., and Washington, D. C., now owns 21 patented and several unpatented claims. Both the Big Seven group and the Lexington group are included in these holdings (fig. 9).

The Big Seven mine has been developed by four main adits. The three upper adits were driven southward along the vein. The Big Seven, or lowest adit, was driven as a crosscut for about 800 feet and then as a drift on the vein for about 2,900 feet (fig. 9). A 200-foot winze was sunk from this drift at a point about 1,500 feet in from the crosscut. About 700 feet of drifting was done on the 180-foot winze level. No stoping was done from this winze level. A block of ore about 300 feet long, however, was mined to a depth of about 50 feet below the Big Seven adit level in one of the ore shoots to the north of the 200-foot winze. Total development, including many sublevels between the Glover and the Big Seven adits, aggregates many thousands of feet.

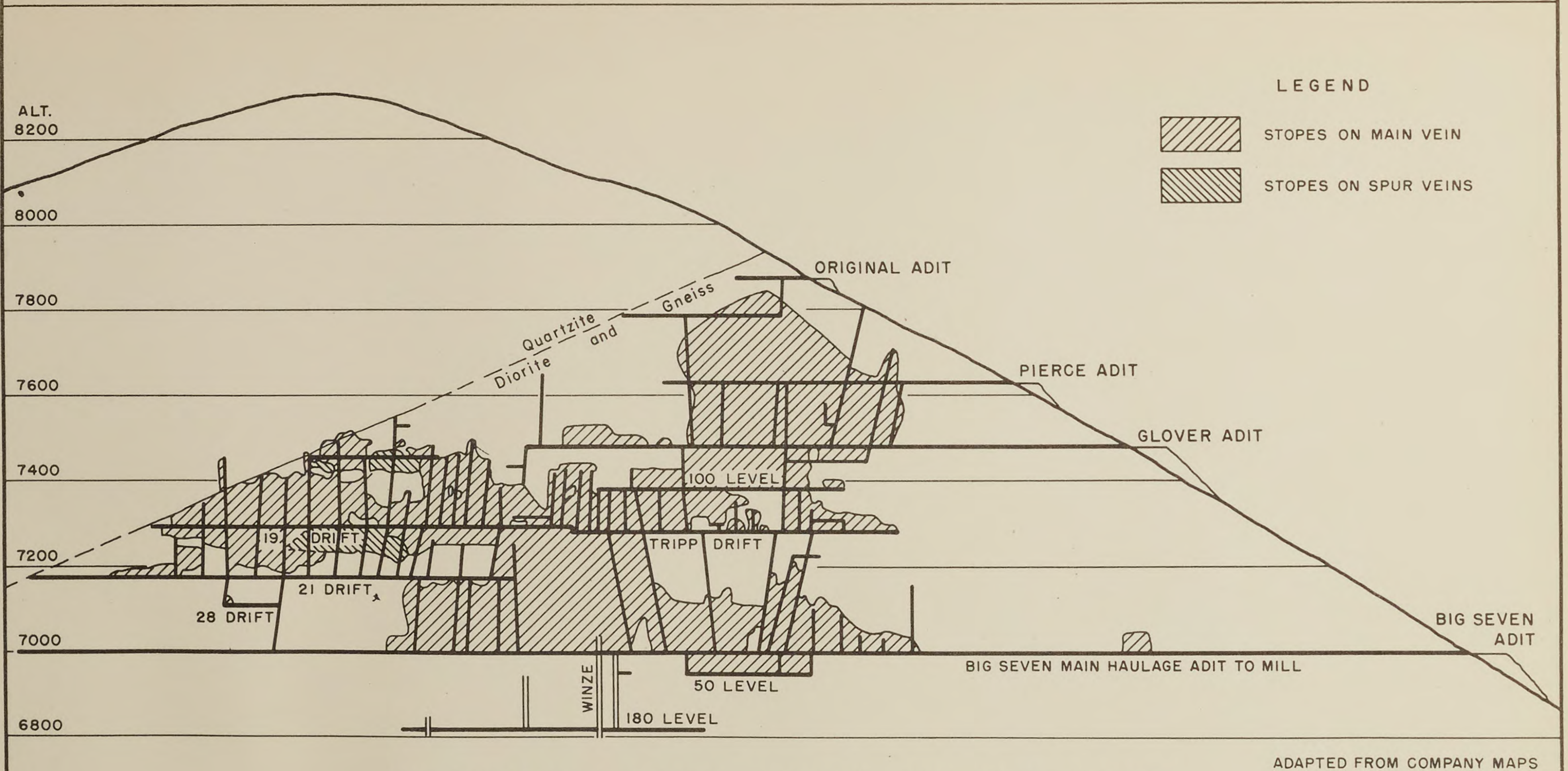
According to Weed (29), the vein followed a well-defined fissure traversing both gneiss and Pinto diorite. It penetrated the Neihart quartzite, which covers the gneiss and diorite on the southern claims. In this locality the vein is about 7 feet wide. It strikes N. 20° E. and is nearly vertical. The vein filling is quartz or quartzite partly impregnated with ore minerals. It often contains considerable amounts of molybdenite. Some of the oxidized ore was very rich but averaged 20 to 50 ounces silver and $5 to $10 in gold a ton.

North of the quartzite the vein strikes about N. 30° to 40° E. and dips about 75° NW. It averages about 5 to 6 feet in width in the gneiss. In the Pinto diorite it ranges from 3 inches to 2-1/2 feet in width. Vein filling consists mainly of altered silicified gneiss or diorite in which the ore minerals occur in bands or lenses. Sometimes two bands or pay steaks were present, usually along the walls to which they generally were frozen. These bands ranged from narrow streaks to 2 feet in width (29). According to Charles Fors, Neihart, Mont., bands to 3 feet in width containing ruby silver were mined in the stopes above the 19 and 21 intermediate drifts. The full width of the vein in these stopes was about 12 feet; the hanging wall was fractured and very loose.

The ore mined before 1897 contained much silver and gold. The ore mined in August 1897 is reported to have contained 100 to 500 ounces silver and $50 in gold a ton. At that time two to three carloads of ore containing about 300 ounces silver a ton were obtained from development (29).



PLAN OF BIG SEVEN & LEXINGTON MINE WORKINGS



LONGITUDINAL SECTION B–B', BIG SEVEN MINE

Figure 9. – Plan and section, Big Seven mine, Montana district, Cascade County, Mont.

Records of production for the years previous to 1902 are not available. Production from 1902 to 1943, inclusive, is reported to have been 143,274 tons of ore, from which 17,538.86 ounces gold, 2,306,353 ounces silver, 63,022 pounds copper, and 523,369 pounds lead were recovered (14).

The ore minerals in the upper parts of the mine were mainly silver sulfides. Lead and zinc minerals were present in small amounts only. In the lower levels, the ore contained several percent of both lead and zinc. The Sulfide minerals were chiefly pyrite, galena, sphalerite, proustite, and perceite. Polybasite probably was present. Small amounts of tetrahedrite (or freibergite), chalcopyrite, molybdenite, and arsenopyrite were obserbed microscopically (17).

Two ore shoots, each about 600 feet long, were developed on the Big Seven adit level; they were prospected from a 180-foot winze from this adit level for a length of over 700 feet. Long adits driven at lower elevations from other properties would develop the veins below the present workings.

When visited in August 1949, all of the upper adits were caved or otherwise inaccessible. Snow drifts covered the Big Seven adit portal. It was reported later that this adit had been reopened and drained during the fall of 1949 and had been repaired nearly to the winze.

Lexington (Ag-Pb)

The Lexington group of five patented claims is northwest of the Big Seven group. The Lexington, Union, and Mountain View claims were located in August 1891 by the Lexington Consolidated Mining Co. The Pennsylvania and Vesuvius claims were located by Daniel Lenny, et al, in 1891 and 1892; they were acquired later by the Lexington Consolidated Mining Co. This company did not operate, but leased to various lessees. In 1905 the claims were reported to be owned by Allan Pierse and W. H. Harrison (23). Control was obtained later by a resident of Choteau, Mont., who deeded it to the Protestant Hospital in Great Falls, Mont. Subsequently, the claims were owned by the Montana Silver Queen Mining Co., then by the Lexington Mining Co., and then by the Lexington Silver Lead Mines, Inc., the present owners.

Principal mine workings are on the Lexington claim, where the Lexington vein has been developed mainly by three adits ranging from about 360 feet to nearly 1,000 feet in length. The strike of the vein is about N. 20° E.; its dip is about 80 NW. (fig. 9).

According to an unpublished Bureau of Mines report, the vein is about 3 feet wide. The vein occurs in Pinto diorite and gneiss; it extends southward under the Neihart quartzite, which overlies the southern end of the Lexington claim.

No production records are available. It is reported, however, that a considerable tonnage of silver-lead ore was mined. The workings were reported inaccessible in 1949.

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Ripple (Ag-Pb-Zn)

The Ripple mine is in upper Snow Creek Valley about 2 miles northeast of Neihart. It is between the Flora and the Tom Hendricks claims, which are owned by the Benton Group Mining Co., et al.

The Ripple claim was located in May 1883 by Andrew J. Briggs. It was operated by the Ripple Mining Co. in 1905 and 1906, when 200 to 300 tons of high-grade ore was mined monthly (23). An adit crosscut had cut the vein about 200 feet below the upper workings before 1910 (25). The mine was owned and operated by Barker Brothers during 1911-12 (26). Later, an operating company was formed. Dave Barker's half interest was purchased by Robert A. Nathan, Great Falls, Mont. The remaining interests are owned by Matthew H. Brown, William Brown, and Charles Brown, all of Great Falls, Mont., and Mrs. Hall, Spokane, Wash.

Various lessees have operated the property. These included C. L. Kirk, the Montana Leasing Co., the Lexington Mining Co., and the Lexington Silver-Lead Mines, Inc. Operations on the Ripple claim were nearly continuous from 1906 to 1924. The mine was idle from 1925 to 1939. In 1939 C. L. Kirk conducted a small operation. The property was idle again in 1941 and 1942. In 1943 several thousand tons of dump material were milled by the Montana Leasing Co. (22-1943). Later operations by the Lexington Mining Co. and the Lexington Silver-Lead Mines, Inc., continued until April 1948, when all mining and milling at the nearby Lexington 150-ton selective flotation plant ceased. No work has been done on the property during the past year.

No production records previous to 1906 are available. Production from 1906 to 1945, inclusive, is reported to have been 25,634 tons of ore, which yielded 1,144.54 ounces gold, 523,857 ounces silver, 3,805 pounds copper, 749,937 pounds lead, and 7,235 pounds zinc (14). Production during 1946 and up to April 7, 1947, amounted to 974.22 tons of ore and concentrates, which, according to smelter settlement data provided by R. A. Nathan, had a gross value of $105,815.68.

The mine has been developed by four main adits and by two short adits on the north end of the claim (fig. 8). One of the short adits was driven southward into the Ripple claim from the Flora by C. L. Kirk in 1939-40. A short ore shoot was developed and mined. The other adits developed the ore shoot, which extends downward to the south under the Neihart quartzite. Three of the adits were extended into the Tom Hendricks claim and served to develop the vein on that claim.

The vein, traversing Pinto diorite and quartzose gneiss, strikes about N. 20° E. and dips steeply to the northwest. It averages 2 to 4 feet in width over most of the length of the claim. The vein material is mainly crushed, altered gneiss or diorite and quartz. The sulfide minerals consist mainly of galena, sphalerite, and pyrite with a small amount of chalcopyrite with which silver sulfides are intimately associated. These minerals occurred both as bands and as disseminations in the vein material. During the earlier operations, only the richer parts of the vein were mined. However, much of the ore mined was sorted out and discarded to avoid excessive penalties for the contained zinc. Some of the dump material and gob filling was milled in later years. Much gob material still remains in the old stopes.

Several ore shoots were developed from the lower, or Flora, adit, especially at splits or branchings of the main vein. No ore has been mined below this adit level. Deep development of the Flora-Ripple-Tom Hendricks vein and its southward continuity under the quartzite could be accomplished by driving a low-level adit from the south side of Neihart Baldy Mountain.

When visited in 1949, the upper adits were closed by caving. The Flora adit was closed at the portal by snow and ice.

Tom Hendricks (Ag-Pb-Zn)

The Tom Hendricks claim is one of the Benton group. It is south of the other Benton group claims and in the saddle between Neihart Baldy and Long Baldy Mountains. It is about 1-3/4 miles northeast of the town of Neihart.

The claim was located January 1, 1886, by J. T. Armington, et al. A 19/30 interest in the claim was acquired later by the Benton Group Mining Co.; the remaining 11/30 interest is owned by Spencer, Mayn, and Heitman heirs, White Sulphur Springs, Mont. (see Benton group).

Little can be learned of its early history. It has been mined by D. L. Ledbetter, J. J. Stewart, the Lexington Mining Co., the Montana Leasing Co., and, after December 1, 1946, by the Lexington Silver-Lead Mines, Inc. (22-1946). This latter company operated the mine for James A. Allen and F. C. Keane, who leased it from the owners in February 1945. Operations by this company terminated April 23, 1948.

Production records for the Tom Hendricks mine are not available. Because of the many leasing operations on the Benton group of claims, production from the Tom Hendricks mine has not been segregated. It is known, however, that a large part of the production from the Benton group between 1944 and 1948 was made from the Tom Hendricks claim. G. K. Spencer has estimated the net value of ore and concentrates shipped during those years at about $243,000. Ledbetter is reported to have produced a considerable amount of rich ore during the time he operated the mine. J. J. Stewart is reported to have produced about $60,000 worth of ore (17).

The Tom Hendricks main vein has been developed by three main adit drifts, all of them driven from other properties (fig. 8). The upper drift was driven a short distance on the vein from a crosscut driven eastward from the Big Snowy adit. A winze was sunk on the vein from this level. This winze connected with the Lower Ripple adit drift, which was extended into the Tom Hendricks claim for several hundred feet. Later, the adit drift from the Flora claim was extended south through the Ripple claim, the fractional Sixteen-to-One claim, and into the Tom Hendricks claim for about 1,000 feet. Numerous raises connect the lower adit with the upper workings.

The main vein and several other veins on which some development was done traverse light-colored gneiss and Pinto diorite on the Tom Hendricks claim. These formations are overlain by the Neihart quartzite, which dips 18° to 30° toward the south. In places the veins extend for short distance into the quartzite. Some secondarily enriched ore has been mined from some of these veins in the quartzite, which, however, soon become narrow and unproductive. The main ore shoot on the main vein terminates at the contact of the quartzite capping; it has been developed on all levels above the lowest, or Flora, adit level, where it was drifted on for several hundred feet. Another vein, apparently a branch of the main vein, also was developed near the north end line of the Tom Hendricks claim.

The main vein strikes about N. 20° E. Above the Lower Ripple adit level it dips 75° to 85° NW; below that level it is nearly vertical. According to information obtained from old maps, the vein averaged 3 to 4-1/2 feet in width. The grade of the ore ranged from 4 ounces to as much as 190 ounces of silver a ton. Lead content ranged from 1.6 to more than 4 percent. Zinc content in the upper levels generally was low but increased at depth.

The last company operating the mine at one time considered driving a 2,000-foot crosscut from the main haulage adit on the Big Seven mine in order to attain an additional depth of 155 feet on the main Tom Hendricks vein.

Cornucopia (Ag-Pb-Zn-Au)

The Cornucopia claim is one of a group of 12 patented claims on the northeast slope of Long Baldy Mountain near the headwaters of the east fork of Snow Creek, about 3 miles southeast of Neihart. One of the claims, the Ontario, was located in August 1885; the others were located by the Cornucopia Mining Co. in 1891.

Development consists mainly of three adit drifts and a 300-foot, 2-compartment shaft with levels at 150 and 300 feet. Most of this development was done in 1891 and 1892 (9) (10). The mine was operated by the Cornucopia Mining Co. for several years, but only a few carloads of ore was shipped (17). In later years the mine was operated intermittently by lessees. The last work was done by Charles Mackey, who advanced one of the adit drifts several hundred feet toward the shaft. Present ownership is divided: H. L. Maury and five sons of Senator James E. Murray hold a three-fourths interest; A. G. Shone, Butte, Mont., one-eighth; and J. J. Stewart, Spokane, Wash., one-eighth. No production records are available.

The vein, as exposed at the portal of one of the adits, is composed of abou 12 inches of rusty quartz with about 2 feet of altered, banded Pinto diorite on each side. It strikes N. 13° E. and dips 78° W. Material on the dump indicates the vein traverses gneiss as well as Pinto diorite. Elsewhere the vein is reported to have contained a narrow stringer of sulfide minerals 1 to 6 inches in width. The dump material shows the presence of oxides and carbonates as well as galena, sphalerite, pyrite, and small amounts of chalcopyrite.

A Bureau of Mines sample selected from a small pile of sorted ore found on the dump of the adit extended by Mackey assayed 1.46 ounces gold, 53.5 ounces silver, 5.7 percent lead, 13.8 percent zinc, 0.14 percent copper, 0.10 percent antimony, and 0.10 percent cadmium.

According to Charles Fors, Neihart, Mont., very little ore was mined, as it contained too much zinc to permit its profitable mining and shipment at that time.

When visited in 1949, the shaft had collapsed and the shaft house had fallen into the resulting depression. The Mackey adit was inaccessible owing to caving at the portal.

Black Diamond (Ag-Pb-Zn)

The Black Diamond group of five patented claims in on the ridge between the upper forks of Snow Creek about 2 miles up Snow Creek from its junction with Carpenter Creek.

The biennial report of the Montana Inspector of Mines for 1909-10 (25) states that 1,100 feet of adits had been driven and several veins containing concentrating ore had been intersected. At that time the property was owned and operated by the Black Diamond Mining Co. A 50-ton gravity-type mill was constructed in 1909-10 and operated for 2 or 3 years. The group now is owned by Ralph G. Parker, Great Falls, Mont. No production data are available.

Material in the dumps near the old mill indicates that the adit penetrated gneiss and Pinto diorite. The dump at a caved shaft on the ridge above the adit is composed of coarse-grained porphyry.

A Bureau of Mines sample of sulfide ore found in the ore bin at the old mill assayed 0.15 ounce gold, 22.7 ounces silver, 5.4 percent lead, less than 0.05 percent zinc, 0.1 percent antimony, and 0.05 percent cadmium.

When visited in 1949, the main adit was closed by a cave at the portal; other workings also were inaccessible.

Lexington No. 2 (Au-FeS_2)

The Lexington No. 2 claim, unsurveyed, adjoins the Black Diamond group at the northwest. It is about 1-1/2 miles up Snow Creek from its junction with Carpenter Creek. The claim was located by the Lexington Mining Co.

A vein in altered gray gneiss was cut by an adit about 20 feet in from its portal and drifted on for a short distance to the south. These workings now are inaccessible owing to caving at the adit portal. The dump contains large fragments of iron pyrite with a small amount of quartz. The iron pyrite is coarsely crystalline and is reported to contain a little gold. Some arsenopyrite may be present. Virtually no oxidation was noticeable. The property is referred to locally as the "iron" mine.

I.X.L. - Eureka (Au-Ag-Pb)

The I.X.L. and Eureka claims are on the north slope of the main ridge between Rock Creek and Snow Creek, about 2 miles northeast of Neihart. The claims were located in the 1880's and were worked extensively before 1897 by different owners and lessees. About 1905 or 1906 a 10-stamp mill and cyanide plant were constructed on Snow Creek about 1 mile up from its junction with Carpenter Creek. This plant was operated for a short time only. Later operations were conducted intermittently by lessees. The property now is owned by Lee M. Ford, et al, Sun River, Mont.

No data on production previous to 1906 are available. Production from 1906 to 1932, inclusive, is reported to have been 1,188 tons of ore, from which were recovered 297.22 ounces gold, 11,112 ounces silver, and 2.807 pounds lead (14). According to Alex Harrison, Great Falls, Mont., only one small bar of silver bullion was produced when the cyanide plant was operated.

According to Weed (29), the ore occurred in disseminated deposits in fractured Snow Creek porphyry. Development was by a 250-foot shaft with two levels, several adits, and numerous surface pits and trenches. The ore minerals were mainly sooty silver sulfides with manganese oxides and some native silver. Some ore contained a considerable amount of gold. According to Weed, the ore did not extend deeper than 90 feet below the surface.

All of the old workings were inaccessible when visited in 1949.

Mountain Chief (Pb-Zn-Ag)

The Mountain Chief mine is on the north slope and at the top of the main ridge south of Carpenter Creek, about three-fourths mile northeast of the Star group of claims.

The claim was located August 8, 1881. It was purchased from the original owners in 1884 by the Hudson Mining Co. for $18,000 (29). Development was begun immediately. The first ores mined were very high-grade. According to Weed (29), over $10,000 worth of ore was extracted during the sinking of the first 20 feet of the south shaft near the top of the ridge. A concentrator and a small smelter were constructed. The rich ore did not continue to depth. The lower-grade ore was not concentrated or smelted successfully. When the ore above the upper adits was depleted in 1890, all operations ceased. In 1893 the property was owned and operated by Sampson Bros., who later abandoned it (18). In 1939 it was purchased for taxes by J. C. Barker and Duane Hervig. It now is owned by Mrs. Eulalie B. Toole and Duane Hervig, Great Falls, Mont. No production data are available.

Development consists of four shafts, the deepest being 310 feet, and three or more adits (16). According to Weed (29), the upper drift adit was 700 feet long. It cut masses of feldspar gneiss included in the Pinto diorite. In places the vein follows the contact of these rocks with diorite on the hanging wall and gneiss on the footwall. About 500 feet in from the portal the vein crosses a porphyry dike. The vein ranges in width from 30 to 40 inches. A crosscut driven into the footwall from this adit cuts two veins, one at 33 feet and the other at 43 feet. The first vein, about 3 feet wide, was barren where cut. The second vein, about 2 feet wide, contained a band of good ore minerals.

A second adit, about 900 feet above Carpenter Creek, is about 1,000 feet long. The vein exposed in this adit is but a foot or so wide where it traverses Pinto diorite for several hundred feet. About 600 feet in from the portal the vein widens to about 7 feet. It contains an ore shoot that was stoped to the upper adit and to the surface (29). At the surface this vein is about 2-1/2 feet wide; it strikes N. 4° W. and dips about 80° to 85° SW.

A lower adit, nearly 1,700 feet long, was driven southward from the north end of the "88" claim, which adjoins the Mountain Chief at the northwest. At that time the "88" claim also was owned by the Hudson Mining Co. No important ore bodies were encountered by this adit, although a vein containing low-grade ore was intersected near the face (17). According to W. B. Carroll, Great Falls, Mont., the adit was driven at a slight angle with the Mountain View vein. When operations were suspended in 1890, the main vein had not been reached. Material on the "88" dump indicates the adit penetrated Pinto diorite, quartz porphyry, hornblende gneiss, and red and gray gneiss. Quartz vein material containing galena, sphalerite, pyrite, and chalcopyrite was found in the dump.

The dumps at the upper adits contain several hundred tons of oxidized ore, consisting mainly of spongy masses of cerussite, smithsonite, manganese oxides, limonite, hematite, and quartz, with small amounts of galena, sphalerite, and pyrite.

Indications are that most of the ore mined above the middle adit was highly oxidized and leached. No ore was mined below the middle adit. None of the mine workings were accessible when visited in 1949.

Eighty Eight ("88") (Ag-Pb-Zn-Cu)

The Eighty Eight group of five patented claims extends to both sides of Carpenter Creek about 1 mile up from its junction with Belt Creek. The "88" and the Fraction claims adjoin the Mountain Chief claim at the north.

Most of the claims were located by the Hudson Mining Co. in the 1880's. Little work has been done since the Hudson Mining Co. ceased operations in 1890. Though some ore is known to have been mined from the "88" claim, no production records are available. The group now is owned by the Combination Gold Mining Co., c/o W. B. Carroll, Great Falls, Mont.

Two southward-trending adits have been driven on the "88" claim. The lower adit is reported to be about 1,700 feet long. As indicated by the dump material, this adit penetrated several varieties of gneiss, porpyry, and diorite. A small amount of material on the dump contains galena, sphalerite, pyrite, cerussite, and iron oxides in quartz and ankerite. According to W. B. Carroll, this adit was driven to develop the Mountain Chief vein at depth but was driven nearly parallel to or at a slight angle with that vein.

The upper adit is about 400 feet higher in altitude and about 1,000 feet south of the lower adit. The dump material at the upper adit is mainly an altered light-colored porphyry. No ore minerals were in evidence.

A Bureau of Mines sample of ore found on the lower adit dump assayed 0.015 ounce gold, 0.2 ounce silver, 17.0 percent lead, 22.3 percent zinc, and 3.4 percent copper.

The adits were inaccessible in 1949.

New Alicia and New Rodwell (Ag-Pb-Zn-Cu)

The New Alicia and New Rodwell claims are about one-fourth mile north of the open pit of the Silver Dyke mine. They are at a high altitude on the north slope of the divide between Squaw Creek and Hoover Creek. The claims were located by a Mr. Combs in 1923 but later were abandoned. Paul Vdovic of Neihart, Mont., purchased the claims from Cascade County in 1941.

The New Alicia claim has been explored by numerous trenches and open cuts and an adit drift about 150 feet long. The vein followed by the adit traverses altered, silicified quartz porphyry. According to Vdovic, the vein is composed mainly of quartz. It averages 2 to 6 inches in width, widening in places to 24 inches. It contains galena, sphalerite, pyrite, chalcopyrite, and their oxidized products. No information is available regarding the development on the New Rodwell claim. No ore has been shipped.

A Bureau of Mines sample taken from a pile of sorted ore on the New Alicia adit dump assayed 1.1 ounces silver, 0.01 ounce gold, 3.6 percent lead, 5.2 percent zinc, and 7.5 percent copper.

The adit was caved at the portal when visited in 1949.

Hatchet (Pb-Zn-Ag)

The Hatchet claim is about 1-1/4 miles up Carpenter Creek and about one-fourth mile east of the "88" claim. It was located in the 1880's and worked intermittently for several years. Since then it has been idle. It is one of three claims now owned by the Silver Horn Mining Co., c/o J. P. Healey, Belt, Mont.

According to Healey, the vein was developed by an adit drift 300 to 350 feet long. The dump material consists of Pinto diorite, gray gneiss, feldspar porphyry, and quartz porphyry. The vein is narrow and irregularly mineralized. Some ore was developed, but it contained too much zinc at the time to warrant shipment to a smelter.

When visited in 1949, the adit was caved at the portal.

Hegener (Ag-Pb-Zn-Cu)

The Hegener group of 10 patented claims is on Mackay Creek about one-half to three-fourths mile above its junction with Carpenter Creek.

The claims were located in the early mining days. They were consolidated later into one group by Joseph Hegener. Most of the development during the early years was done on four of the claims: the Vilipa, originally the Phillippi, Gold Rock, Copper Queen, and Baker. Present owners are John Hegener and Marie Hegener, Great Falls, Mont.

The Vilipa claim was developed in 1897 by a 100-foot adit (29). A 115-foot shaft was sunk on the vein in 1902. A drift at the botton of the shaft followed the vein southward for 300 feet. The adit was extended to a length of about 400 feet (17). The vein followed the contact along a hanging wall of dark-gray micaceous schist and a footwall of altered porphyry (29). The ore contains galena, sphalerite, pyrite, and silver sulfides. Polybasite was observed in the ore (17). A shipment of 11 tons of ore to the Puget Sound Reduction Co. in August 1901 contained 0.15 ounce gold a ton, 259.8 ounces silver a ton, and 2.7 percent lead. Another shipment of about 12 tons, sent to the same smelter in February 1902, assayed 0.12 ounce gold, 114.1 ounces silver, and 1.0 percent lead. A Bureau of Mines sample selected from ore found on the Vilipa dump assayed 0.06 ounce gold, 111.2 ounces silver, 0.2 percent copper, 0.6 percent lead, and 2.3 percent zinc.

The Gold Rock vein strikes north. It was developed by a 100-foot shaft with a north drift about 50 feet long and a 265-foot adit drift. The vein is reported to be wide and contains a high-grade stringer of sulfides. Sorted ore mined from this stringer averaged 100 ounces silver a ton, 8 percent copper, and 6 to 7 percent lead. The principal ore minerals are galena, chalcopyrite, sphalerite, and tetrahedrite. Native silver, ruby silver, and native copper were present (17). A shipment of 83 sacks of ore sent to the United Smelting & Refining Co. smelter at Great Falls in October 1896 assayed 92.9 ounces silver a ton. No other metals were paid for. Another shipment of about 7-1/2 tons sent to the American Smelting & Refining Co. smelter at Great Falls in July 1899 assayed 44.9 ounces silver a ton. A selected sample of ore from a small vein parallel to and 26 feet distant from the main Gold Rock vein is reported by John Hegener to have assayed 1.10 ounces gold and 710.25 ounces silver. Three small lots of sorted ore from the Gold Rock vein were shipped by lesses to the Washoe Sampler at Butte in October 1922; they assayed 0.1 ounce gold and 94.4 ounces silver, 0.03 ounce gold and 46.8 ounces silver, and 0.04 ounce gold and 61.0 ounces silver.

The Copper Queen vein strikes north. It was developed by two adits - a 165-foot drift adit and a 100-foot crosscut adit. The principal ore minerals are similar to those in the Gold Rock vein (17).

The Baker vein was developed by a 75-foot crosscut adit, which cuts a wide, low-grade, mineralized zone containing some chalcopyrite.

According to John Hegener, the ore produced from the claims had a value of $25,000 to $30,000.

The veins on the claims traverse various gneisses, Pinto diorite, and Snow Creek quartz porphyry, all crossed by a network of dikes mainly of quartz porphyry and granite porphyry. The rock formations in the immediate area are brecciated similar to the brecciation at the Silver Dyke mine (17). In places the brecciated porphyries contain masses and small stringers of sulfide minerals that have been secondarily enriched. One such area on the east side of the Gold Rock claim, near its northern end, has been prospected by many shallow pits, trenches, and short adits. Other brecciated areas containing disseminated sulfide minerals occur along or near the larger veins on the other claims. They have been prospected to shallow depths.

When visited in 1949, all mine openings were inaccessible.

Double X ("XX") (Ag-Pb-Zn)

The Double X claim is on the upper fork of Mackay Creek about three-fourths mile upstream from its junction with Carpenter Creek. It now is included in the Silver Dyke group of claims. H. L. Maury and A. G. Shone of Butte, Mont., are the principal owners.

The claim was located in the early 1880's. Little could be learned of its history or production. The last work was done by lessees about 1934.

According to Schafer (17), the vein follows a well-defined fracture along a porphyry-gneiss contact. According to John Hegener, Great Falls, Mont., it was developed by an adit 300 to 500 feet long and by numerous pits and shallow shafts. Material on the adit dump indicates that the adit penetrated light-colored altered porphyry, gray gneiss, and basic dikes. Pieces of vein quartz found on the dump contain massive galena, light-yellow sphalerite, pyrite, chalcopyrite, and brittle silver sulfides. Weed reports that the rich ores of Upper Mackay Creek were found mainly in rhyolite porphyry; they were the result of secondary enrichment (29).

The Double X adit was closed by a cave a short distance from its portal when visited in 1949.

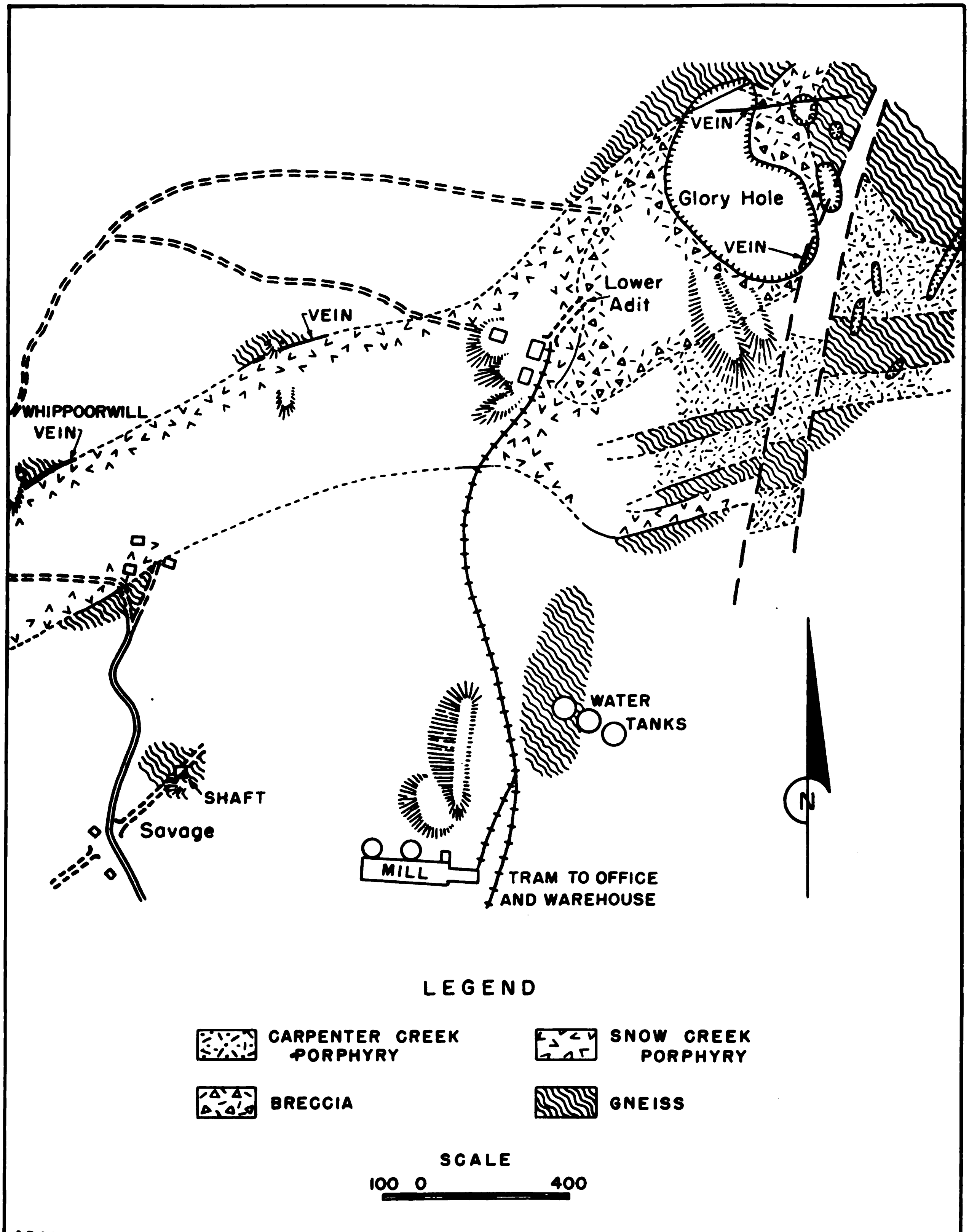
Dawn and Foster (Pb-Zn)

The Dawn and Foster claims are on the upper west fork of Mackay Creek about 1 mile west of the Silver Dyke mine.

The claims were located in January 1890 and January 1891 by Henry B. Mackay. By 1897 the vein had been developed by several hundred feet of adit drifts (29). Since that time no work has been done. The claims now are owned by Adaline A. Kenkel, Great Falls, Mont.

According to Weed, the ore developed was low-grade and contained much zinc (29). A specimen of nearly pure galena from the claim contained only 0.15 ounce silver a ton. The vein is a well-defined quartz-filled fissure that follows a porphyry-gneiss contact.

The workings were reported to be inaccessible in 1949.



ADAPTED FROM FIG. 12, MONTANA BUREAU OF MINES AND GEOLOGY, MEMOIR NO. 13

Figure 10. - Sketch showing the geology and surface plant at Silver Dyke mine and vicinity, Montana district, Cascade County, Mont.

Cowboy (Pb-Zn-Ag)

The Cowboy claim is about one-half mile up Lucy Creek from its junction with Carpenter Creek. It is about 2-1/2 miles north of Neihart.

The claim was located in the 1880's, but little could be learned of its early history. According to Sidney Goodman, Armington, Mont., the present owner, two cars of oro were shipped in 1896. After that time, the property was inactive until 1946, when it was leased by Cecil Hoops, et al, Neihart, Mont. Hoops reopened the main adit and attempted to pump out an inclined winze that had been sunk on the vein about 50 feet in from the adit portal. A heavy flow of water was encountered. Another adit about 25 feet lower in altitude then was started to drain the winze. In June 1949 this adit had been advanced about 75 feet.

The vein followed by the main adit is in Pinto diorite. It ranges from 1 to 3 feet in width, strikes N. 62° E., and is nearly vertical. The vein, composed mainly of quartz, calcite, and ankerite, contains bunches and disseminations of galena, sphalerite, and pyrite, with small amounts of silver sulfides. According to Hoops, the winze was sunk on an ore shoot about 75 feet long, which raked steeply to the southwest.

No ore has been shipped since work began in 1946. About 25 tons of sorted ore is stored on the dumps and in an ore bin near the main adit. A Bureau of Mines sample of this ore assayed 4.7 percent lead, 9.8 percent zinc, 0.4 ounce silver, 0.3 percent copper, a trace gold, and less than 0.01 percent tungsten.

When visited in 1949, both adits were open and in good condition. The winze was filled with water to the adit level.

Silver Dyke (Ag-Pb-Cu)

The Silver Dyke mine (fig. 10) is near the top of a high ridge lying northwest of the forks of Carpenter Creek; it is about 3-1/2 miles up Carpenter Creek from its junction with Belt Creek. The deposit was discovered during the early days of mining but was not developed until 1921. During 1922 and 1923, a 500-ton concentrating mill was constructed by Stearns and Rogers. Control of the property then was acquired by the American Zinc, Lead, and Smelting Co. This company began operating in February 1923. In 1926 the mill capacity was increased to 950 tons. Operations continued until April 1929, when the blocked out ore was depleted. A small production was made later by leasers. The property now is owned by H. L. Maury and A. G. Shone, Butte, Mont.

Total production from the Silver Dyke mine as to tonnage mined and quantity of silver, lead, and copper recovered was considerably larger than that of any other mine in the Neihart area. The tonnage mined was obtained from a comparatively small area in which the minerals occurred as disseminations in a brecciated mass of quartz porphyry, granite porphyry, and gneiss. The eliptical deposit was approximately 600 feet long and 400 feet wide. It was mined to a depth of about 150 feet.

The deposit was mined first by open-cut methods (fig. 10). The ore mined in the open-pit or glory hole was delivered through chutes to an adit below, from whence it was trammed to the mill. Later, a lower adit about 1,000 feet long was driven at an altitude of 6,870 feet. Four or more paralleling drifts were driven from this lower adit at 80-foot centers. Two sets of vertical raises 100 feet apart were driven to connect with the workings above. All ore from the open-pit and intervening underground workings then was delivered to the new lower adit, which because the main haulage level (30). Ore from the open-pit was withdrawn through chutes as rapidly as possible to prevent packing of the sticky material. During winter months, or when wet weather interfered with open-pit operation, mining was done underground. Because of the shape, size, character, and attitude of the deposit, extensive underground workings were not required.

During an 8-month period, 1926-1927, when about 700 tons of ore was being milled daily, the cost of mining, including overhead and management charges, was only 42¢ per ton (30). At that time mill heads contained 0.78 percent copper, 1.56 percent lead, and 4.48 ounces silver a ton, of which about 16 percent of the lead and 25 percent of the copper were oxidized. Tailings average 0.22 percent copper, 0.44 percent lead, and 0.91 ounce silver a ton. About 23 percent of the lead and 46 percent of the copper in the tailings were in the oxidized forms. Recoveries were excellent, considering the physical character of the ore and its chemical composition; they averaged 72.94 percent of the copper, 73.09 percent of the lead, and 80.55 percent of the silver. The ratio of concentration was 13.15. A lead concentrate and a copper concentrate were produced by flotation. The lead concentrate was shipped to the East Helena smelter; the copper concentrate went to the copper smelter at Anaconda. Cost of hauling the concentrates by truck to the loading platform at the railroad, 3-1/2 miles distant, was $1.50 a ton (30). Production from 1921 to 1948, inclusive, is reported to have been 1,167,125 tons of ore, from which 1,736.67 ounces gold, 3,177,068 ounces silver, 7,453,527 pounds copper, 16,367,760 pounds lead, and 8,428 pounds zinc were recovered (14).

The ore was a complex mixture of both sulfide and oxide or carbonate minerals disseminated in a gangue of highly altered quartz porphyry and gneiss. Minerals present were galena, cerussite, pyrite, chalcopyrite, malachite, azurite, iron oxides, and small amounts of sphalerite. The silver minerals were not identified. The ore contained about 20 percent colloidal material, principally kaolin (17).

The origin of the ore has not been definitely determined. It is possible that brecciation occurred when the Carpenter Creek porphyry was injected into the more brittle Snow Creek porphyry. Solutions containing the ore minerals penetrated the breccia and were deposited irregularly. The nearby Whippoorwill and Savage veins may have been the feeder channels through which the mineral-bearing solutions circulated.

In 1949 the adits were inaccessible; the big open-cut had sloughed from the sides and contained much debris. Access raises from the underground workings were caved.

Savage (Pb-Zn-Ag)

The Savage mine is on the east side of Squaw Creek about one-fourth mile from its junction with Carpenter Creek. The claim was located in 1885 by the Savage Lode Mining Co. For many years it has been included in the Silver Dyke group of claims. It now is owned by H. L. Maury (2/5) and A. G. Shone (3/5), both of Butte, Mont. The mine was operated by Buskirk, Berland Bros., and Paul Vdovic in 1948 and 1949. The ore mined and some coarse tailings from the old Silver Dyke mill were treated in a small selective flotation plant erected by these lessees at the site of the old Silver Dyke flotation plant.

In the earlier days, the mine was worked through a 100-foot shaft sunk on the vein. Ore was stoped to about 50 feet above a drift driven north from the bottom of the shaft. The present lessees drove an adit drift on the vein from near Squaw Creek to the shaft and beyond for a length of 400 to 500 feet (fig. 10). Some ore was found just south of the shaft and was stoped for a short distance above the adit level. This work terminated during the summer of 1949. No production data are available.

The vein traverses an altered gray gneiss. It strikes N. 40° to 45° E. and dips 75° to 80° NW. Where exposed in the stope south of the shaft, the vein is 3 to 5 feet wide. It is composed mainly of altered banded gneiss containing some disseminated sulfides, with two narrow bands of sulfide minerals near the walls. The principal sulfide minerals are galena, sphalerite, and pyrite, which usually occur in fairly large crystalline form. Some of the sphalerite and pyrite are coated with films of silver sulfides.

A Bureau of Mines sample of ore found in the mill ore bin assayed 0.025 ounce gold, 29.8 ounces silver, 3.1 percent lead, 3.6 percent zinc, and 0.1 percent copper.

Power for the small mill was obtained from the Montana Power Co. line leading to the nearby Silver Dyke mine. Both lead and zinc concentrates were produced. The lead concentrate was trucked to East Helena. The zinc concentrate was shipped to Great Falls.

When visited in 1949, the adit was in good condition and accessible to its face, about 75 feet north of the old shaft.

Whippoorwill (Blotter)(Ag-Pb)

The Whippoorwill claim, patented as the Blotter, adjoins the Double X claim at the northeast. It is on the ridge between the headwaters of Mackay Creek and Squaw Creek, about one-half mile southwest of the Silver Dyke mine.

The claim was located in the early 1880's. It has been worked intermittently since 1884 by the Whippoorwill Mining Co., the Silver Dyke Mining Co., and by various lessees (10). The last work was done about 1922 or 1923 by the Carpenter Creek Mining Co. The present owners are H. L. Maury and A. G. Shone of Butte, Mont.

The Wippoorwill vein occurs along a contact of Snow Creek quartz porphyry with gneiss. It was developed by a shaft reported to be 250 feet deep, with crosscuts and drifts on several levels (1). A 40-foot winze was sunk, and some drifting was done by the Silver Dyke Mining Co. in 1922. Ten tons of lead ore is reported to have been shipped during the same year by the Carpenter Creek Mining Co. (22-1922).

The ore is reported to contain galena, sphalerite, and notable amounts of chalcopyrite. The silver content is low, except near the surface, where it is secondarily enriched (17).

The mine workings were inaccessible in 1949.

Sherman (Flamsburg) (Ag-Pb-Zn)

The Sherman claim, Survey No. 10,442, was known for many years as the Flamsburg. It is on Carpenter Creek about 3-1/2 miles up Carpenter Creek from Belt Creek and about 150 yards southeast of the Savage mill.

The claim was located in the 1880's and was operated intermittently on a small scale for several years. Lessees operated the property about 1933 or 1934 and produced some ore from a shallow adit and surface pits. In recent years the lower adit was reopened by Berland Bros., Buskirk, and Vdovic. A small mill was constructed. Some ore and dump material were milled. A bulk lead-zinc-silver concentrate was produced on one large concentrating table. Some dump material was treated later at the Savage mill. The property is owned by H. L. Maury (7/10) and A. G. Shone (3/10), both of Butte, Mont. No production data are available.

According to Paul Vdovic, the vein has been developed at an adit drift about 400 feet long, by an adit crosscut about 50 feet long, and by a shaft about 35 feet deep. The adit drift follows a fissure vein in Snow Creek porphyry and gray gneiss. The vein, from 2 inches to 24 inches wide, strikes N. 15° to 41° W. It dips 75° to 80°NE. According to Wm. Mehaney, Neihart, Mont the ore in this adit occurred in short lenses ranging in width from 1 to 12 inches. The vein walls were kaolinized and soft.

Sorted ore mined from the shaft and a small underhand stope is reported by Vdovic to have contained as much as 46 percent lead and 36 to 40 ounces of silver a ton. Galena, sphalerite, pyrite, chalcopyrite, and silver sulfides are the principal sulfide minerals. Some cerussite also is present. Schafer (17) reports the presence of pyromorphite occurring as thin needles associated with the galena. The gangue minerals are calcite, limonite, ankerite, and quartz. A Bureau of Mines sample of ore found on the dump at the lower adit assayed 1.4 ounces silver, 22.2 percent lead, 21.1 percent zinc, 1.1 percent copper, and a trace gold.

When visited in 1949, the lower adit was blocked by a cave near the portal; the shaft had caved.

Minute Man (Last Hope-Westgard) (Ag-Pb-Zn)

The Minute Man, known also as the Last Hope and as the Westgard claim, is on the side hill south of Carpenter Creek about one-fourth mile south from the Savage mill. It is about 3-1/2 miles northeast of Neihart.

According to Wm. Mehaney, Neihart, Mont., the claim was located about 1924 by Thomas Westgard. It was worked intermittently by him for several years. After Westgard's death, his interests were acquired by Dan Reeder and George Spehn of Great Falls, Mont. No developing has been done in recent years, although a new road was bulldozed to the main adit in 1948.

Production from 1932 to 1944, inclusive, is reported to have been 317 tons of ore, from which 5.45 ounces gold, 3,278 ounces silver, 2,839 pounds copper, 33,912 pounds lead, and 31,771 pounds zinc were recovered (14).

Development consists of several adits and a 48-foot shaft with a short drift. One of the lower adits is reported to be about 300 feet long (17). The main adit, according to Mehaney, is about 700 feet long. It follows a vein that occupies a strong fracture in gneiss. The vein ranges from 2 to 7 feet in width. Several ore shoots were encountered. Sorting of the ore to a high-grade shipping product, however, was difficult because of the softness of the vein material and the walls. The vein exposed near the portal of the upper adit is composed of three bands of quartz 12 to 24 inches wide separated by 6-inch bands of silicified gneiss. It strikes about N. 60°W. and dips 80° NE. The dump at this adit contains vein material consisting mainly of honeycombed, iron-stained quartz with cerussite, limonite, hematite, and possibly smithsonite.

Vein material found on the dump at the lower adit consists of altered gneiss and quartz containing galena, sphalertie, pyrite, chalcopyrite, and small amounts of silver sulfides. A Bureau of Mines sample selected from this material assayed 0.5 ounce silver, 16.3 percent lead, 1.5 percent zinc, 1.3 percent copper, and a trace gold.

Caved stopes along the strike of the vein followed by the main adit indicate its strike to be about N. 60° W., the same as the strike of the vein showing at the upper adit. The workings, however, appear to be on different but parallel veins.

When visited in 1949, the adits and the shaft were inaccessible owing to caving.

Big Ben Molybdenum (Mo)

The Big Ben group of eight claims and a millsite is on the north slope of the ridge between Snow Creek and upper Carpenter Creek, about 2-1/2 miles northeast of Neihart.

Three of the claims were located by Frank Mansikka of Neihart, Mont., in 1922. He located the other claims and the millsite between 1926 and 1940. All of the claims still are held by Mansikka.

The Big Ben property is reported to have been examined by the Climax Molybdenum Co., Anaconda Copper Mining Co., and the U. S. Vanadium Corp. In 1938 the Federal Mining & Smelting Co. obtained an option and did considerable surface trenching, sampling, and geologic mapping. At the request of the War

Production Board, the property was examined by the Bureau of Mines in 1942 as a possible strategic source of molybdenum.

In 1943 the Bureau of Mines began and completed a program of diamond core drilling, channel-sampling of the underground workings, surveying, and metalllurgical testing. Four diamond core-drill holes were drilled for a combined length of 1,365 feet. The entire length of the Big Ben lower adit was channel-sampled in 5-foot sections. Although the full extent of the mineralized zone was not determined, core-drill holes and adits penetrate a prism 520 feet long, 270 feet wide, and 365 feet deep. Weighted averages of the drill core samples ranged from 0.19 to 0.26 percent MoS_2. Channel samples for a continuous length of 295 feet in the lower adit ranged from 0.01 to 0.32 percent MoS_2 and averaged 0.21 percent. Metallurgical testing indicated that concentrates containing 84 to 88.9 percent MoS_2 can be produced by standard flotation (8).

Development consists mainly of an upper 290-foot adit and a 340-foot lower adit in the Great Ben No. 2 and No. 3 claims. The upper adit is at an altitude of 6,006 feet, 78 feet higher than the lower adit. The face of the lower adit is almost directly under the portal of the upper adit. Short drifts and crosscuts have been driven on the more highly mineralized fissures exposed in the adits. Numerous surface trenches and pits have been dug; one series of trenches with a combined length of about 500 feet was excavated in 1938 by the Federal Mining & Smelting Co.

Mansikka has extended the lower adit about 40 feet since the Bureau of Mines completed its investigation and has drifted to the east along a fracture following the contact of Carpenter Creek granite porphyry and Snow Creek quartz porphyry.

When visited in 1949, both adits were in good condition and accessible to their faces.

The deposit appears to be a stockwork in which molybdenite and other associated sulfide minerals occur in irregular fractures and as disseminations in silicified zones in pre-Beltian gneisses, porphyries, and Pinto diorite. The principal rock in the Big Ben area is a rhyolite porphyry, locally known as Snow Creek quartz porphyry. It occurs as masses and as dikes that cut older gneisses, schists, and diorite. A later intrusive rock, the Carpenter Creek granite porphyry, intrudes the Snow Creek quartz porphyry. Both formations have been fractured and altered. Most of the fractures are quartz-filled; many of them contain molybdenite. The degree of mineralization differs in the different rocks. Samples from the gneiss indicate the mineral content to be lower than that of either the Snow Creek quartz porphyry or the Pinto diorite. The Carpenter Creek granite porphyry is only slightly mineralized. Much of the mineralized area is covered with overburden ranging from 3 to 15 feet in thickness.

Molybdenite, the principal valuable mineral, is associated with pyrite and minor amounts of galena, chalcopyrite, and fluorite; it is replaced partly by molybdite (hydrous ferric molybdate) to a depth of 15 to 20 feet below the overburden. The molybdenite and galena are associated intimately. The presence of tungsten was noted, but samples indicate the average WO_3 content to be less than 0.01 percent.

The occurrence of moybdenite on Snow Creek about 2,500 feet south of the Big Ben deposit, and in the vicinity of Mackay Creek about half a mile and more to the north of the Big Ben is reported by Schafer (17).

Frisco (Ag-Pb-Zn)

The Frisco claim is near the northern limits of the town of Neihart. The claim was located originally in June 1882 but was abandoned later. It was relocated October 10, 1886, by Charles Crawford, et al, and subdivided into town lots, some of which extend across Belt Creek. In 1939, some of these lots on the west side of Belt Creek were purchased from Charles Fors by Spehn and Klies for use as a tunnel site. An adit was driven N. 80° W. from that site for about 625 feet to prospect for a vein considered to be the southern extension of the Equator vein. Two veins were intersected. The first was crossed at about 445 feet, the other near the face. The first vein was drifted south for about 20 feet, where a raise was driven on a short ore shoot. The vein at the face of the adit was drifted on for about 10 feet. The first vein contained some ore but was considered too narrow to warrant further development. Both veins are narrow, quartz-filled fissures in hard, gray gneiss. The first vein, where the raise was driven, contained galena, honey-yellow sphalerite, and pyrite with coatings and films of brittle silver sulfides. No ore was shipped.

A Bureau of Mines sample selected from ore found on the dump assayed 51.6 ounces silver, 0.07 ounce gold, 33.3 percent lead, and 9.5 percent zinc.

When visited in 1949, the adit was open and in good condition to the face. The raise had caved.

Graham and Hollowbush (S & R)(Ag-Pb-Cu)

The Graham and Hollowbush, or S & R, mine is on the west side of Belt Creek near its junction with O'Brien Creek at the southern end of the town of Neihart. Present ownership was not learned.

The vein, believed by some people to be the southward extension of the Broadwater vein, first was developed by an adit driven on the vein from its outcrop near the water level of Belt Creek. According to Carl Faller, Neihart, Mont., some rich silver ore was mined from this adit. No further work was done on the claim until 1934. The property then was leased by George Spehn and Dan Reeder. A 250-foot shaft was sunk in the footwall of the vein, and crosscuts on the 100- and 250-foot levels were driven to the vein. Drifts were driven north and south on both levels. One short ore shoot was mined between the 250-foot shaft level and the adit level. Operations ceased in 1943, when additional pumping equipment was needed to handle the large flow of water encountered on the 250-foot level.

Much of the ore mined was too low grade to permit shipment direct to the smelter; it accumulated on the dumps. This material was milled in 1942 and 1943 in the Klies Milling Co. mill, later known as the Neihart Mine & Milling Co. mill (22-1942).

Production records for the early operations are not available. Production from 1934 to 1943, inclusive, is reported to have been 5,636 tons of ore, from which 6.25 ounces gold, 28,038 ounces silver, 3,506 pounds copper, and 186,445 pounds lead were recovered (14).

According to Joe Boucher, Havre, Mont., the vein was about 2 feet wide on the adit level; on the 100- and 250-foot levels it was 4 to 6 feet wide. It strikes north and dips about 80° to 85° W. The vein is composed mainly of quartz or silicified, altered, gray gneiss. The ore minerals occurred mainly in an irregular band at about the center of the vein. Silver sulfides, pyrite, chalcopyrite, galena, and sphalerite also are isseminated through the vein material. A Bureau of Mines sample of material of this type found on the dump assayed 2.5 percent lead, 2.5 percent zinc, 4.3 ounces silver, 0.1 percent copper, and a trace of gold.

According to Boucher, the vein splits a short distance north of the crosscut on the 250-foot level. The main ore shoot rakes to the south. No ore has been mined below the 250-foot level.

When visited in 1949, the adit was inaccessible owing to caving and accumulated water. The shaft and headframe apparently were in good condition; the shaft was filled with water to about 75 feet below the collar.

Ruth Mary and Fitzpatrick (Ag-Pb-Cu)

The Ruth Mary and Fitzpatrick claims are on the west side of Belt Creek about one-quarter mile south of the town of Neihart.

The Fitzpatrick claim was located in 1883 by John Largent. It was surveyed for patent in October 1883. In 1910 it was owned by Robert Ford (25). It now is owned by Lee M. and Elizabeth W. Ford, Sun River, Mont. The two veins on this claim were developed by adit drifts. The main vein was developed by two adits, the upper one being short. The main, or Firzpatrick, adit, about 30 feet below the upper adit, was driven about 750 feet to the north end line of the Ruth Mary claim. Ore was stoped a short distance in from the portal of the Fiszpatrick adit up to the upper adit level. Farther south, a number of raises ranging from 45 to 120 feet in length were driven in other short ore shoots. The second vein, about 100 feet west of the main vein, was drifted on for about 100 feet.

The Ruth Mary claim, unsurveyed, adjoins the Fitzpatrick claim at the south. Though also located in the 1880's, little development was done until long after operations on the Fitzpatrick claim had terminated. Arrangements were made by Tony Faller, then the owner of the Ruth Mary claim, for the use of the Fitzpatrick adit. Faller then advanced this adit another 550 feet and for several years thereafter mined the Ruth Mary at intervals. A royalty of

25 cents a ton on all ore shipped was paid the owners of the Fitzpatric claim. The Ruth Mary claim was later leased to McCaffrey and Williams, who mined a small amount of ore (22-1922). Some work was done about 1934 by Ton and Charles Huxley. Other lessees produced a small amount of ore in 1937. Since then the mine has been idle. Present owners are Earl and Carl Faller, Neihart, Mont.

One ore shoot nearly 100 feet long on the Ruth Mary claim was mined for a short distance above the adit level. According to Sam Williams, Belt, Mont., this ore shoot occurred about 1,100 to 1,200 feet in from the adit portal. A 65-foot winze was sunk on the vein at the 1,150-foot point, where the vein averaged 3 feet in width. A heavy flow of water prevented further sinking. Several other ore shoots were developed and mined. The ore shoots in the Ruth Mary claim were about equally spaced along the adit, usually at deflections on the hanging-wall or west side of the vein; it widened at these points to 2 or 3 feet and contained a rich band or stringer 6 to 8 inches in width. The vein is reported to be cut off by a fault at the face of the adit.

The Ruth Mary-Fitzpatrick vein occurs in gray gneiss. It strikes N. 3° E. and dips 85° NW. The vein walls are altered slightly to sericite and kaolin (17). The minerals are mainly silver sulfides with galena, sphalerite, pyrite, and a small amount of chalcopyrite. Cerussite was abundant in much of the ore mined. The presence of this mineral along with small amounts of malachite, azurite, and coatings of supergene ruby silver indicates secondary enrichment (17). A Bureau of Mines sample of some ore found in an old ore bin assayed 0.005 ounce gold, 21.3 ounces silver, 1.4 percent lead, 0.2 percent copper, 0.1 percent zinc, and less than 0.1 percent atimony.

According to Carl Faller, 12 tons of ore shipped in 1934 averaged 268 ounces silver a ton. Earlier production records are not available. Production from 1934 to 1937, inclusive, is reported to have been 50 tons of ore, from which 5,096 ounces silver, 1,630 pounds lead, and 251 pounds copper were recovered (14).

When visited in 1949, the main adit was accessible for about 100 feet, where it was blocked by the caving of an old stope. The adit drift on the west vein was open and in good condition.

LeRoy (Johannesburg)(Au)

The LeRoy claim, one of a group of seven patented claims and a millsite, is about 4 miles northwest of Neihart. This area is considered a part of the Montana (Neihart) district, although it also has been known as the Johannesburg district.

The LeRoy mine is about half a mile up Johannesburg Creek, a west tributary of Belt Creek. The claims were located sometime prior to 1905. At that time, they were owned by Nelson and Meetzger, who drove a 100-foot adit with several crosscuts. These crosscuts indicated a mineralized zone about 20 feet wide (23). The claims were abandoned later but were relocated April 13, 1907, by the Johannesburg Gold Mining Co. This company sank a 500-foot shaft with drifts on several levels. Considerable work was done on the 300-foot level, where extensive bodies of low-grade ore were reported (25). Later, the claims again were abandoned. They were purchased eventually for taxes from Cascade County by Paul Vdovic, Neihart, Mont., who is the present owner.

According to Vdovic, the best ore was cut by a crosscut on the 200-foot level. The ore occurs in silicified altered zones in a hornblende gneiss, mainly in small quartz-filled fractures containing iron sulfides, iron oxides, and a little chalcopyrite. The ore is reported to have averaged about 0.20 ounce gold a ton, although picked samples assayed $106 to $550 in gold.

A Bureau of Mines sample of some of the best appearing ore found on the dump at the shaft assayed 0.14 ounce gold, 0.05 ounce silver, 0.05 percent copper, 0.05 percent nickel, and 21.0 percent iron a ton. About 800 tons of oxidized ore is on the mine dump. No ore has been shipped or milled.

When visited in 1949, one of the adits south from the shaft was open and in good condition. The shaft was filled with water to within 20 feet of the collar. Pits and open-cuts on the claims north from the shaft had sloughed.

Other Mining Claims

Other located and patented mining claims in the Montana (Neihart) district have been mentioned briefly in reports and publications. A number of these claims are reported to have been productive of some ore; virtually all of the old workings now are inaccessible. Several of the following claims are included in groups or mines heretofore described.

The Concentrated and Monarch claims (Ag-Pb) are part of the Florence group now owned by the Bennett Mining Co. They adjoin the Florence and British Lion claims on the west. According to Weed (29, a 1,500-foot adit was driven at a slight angle toward the Florence on a vein that averaged 3-1/2 feet in width. A crosscut near the face of the adit intersected another vein. The Inspector of Mines for Montana reported in 1891 and 1892 that the vein was developed by a 1,500-foot adit, and a 2-compartment winze that was being sunk at a point 250 feet in from the adit portal. In 1891 the winze was 60 feet deep. Operations were discontinued in 1892 because of a heavy flow of water encountered in the winze. One 7-ton shipment of ore yielded 108 ounces silver and $5 gold a ton (9)(10).

The Nevada claim (Ag-Pb), Survey No. 2680, adjoins the Galt claim at the north. It was located in October 1886 by William Kane, et al. It now is owned by Neihart Realty Co., c/o J. P. Healy, Belt, Mont. (29/30), and L. B. Stark, Neihart, Mont. (1/30). According to Stark, the vein on the Nevada claim is a continuation of the Galt vein. It has been developed by a 250-foot shaft with several levels. Some good silver ore is reported to have been mined by early owners.

The Hidden Treasure claim (Ag-Pb) lies west of the Broadwater claim; it adjoins the Atlantus and Maggie claims of the Hartley group at the south. An adit several hundred feet long was driven on the Hidden Treasure vein by early operators. No work has been done for many years. It is owned by Mrs. J. E. Sites and Neta Chamberlain of Helena, Mont.

Several groups of claims were located many years ago on both sides of Harley Creek near its junction with Belt Creek. This locality is about 2 miles northwest of Neihart. According to Weed (29), the Imperial group of eight claims had a 450 foot adit, the Royal group had a 200-foot adit, and the Granite Mountain group had a 225-foot adit. Ore samples from the Granite Mountain group are reported to have assayed as high as 12 to 20 per cent copper and several dollars in gold. No work has been done on any of the claims for many years. All workings are inaccessible.

The Blizzard (Ag-Pb) is a fractional claim between the Pennsylvania claim of the Lexington group and the Spotted claim. It is on the top of the ridge between Snow Creek and Belt Creek. Little could be learned of its early history. According to D. L. Ledbetter, Great Falls, Mont., a shaft 40 to 50 feet deep was sunk on the vein; some rich silver ore was mined. The claim is owned by Edith Ledbetter, Great Falls, Mont.

The Bull of the Woods claim (Au-Ag) is near the top of the west slope of the Neihart Baldy Mountain about half a mile east of Neihart. The claim was located April 1, 1890, by Herbert L. Robinson, et al. Later it was owned by Dorcus B. Cottier of Great Falls, Mont., who sold it to D. Reeder and Claus Erlandson. Erlandson's three-fourths interest was purchased later by P. Vdovic of Neihart, Mont. Neihart quartzite is the only rock formation exposed. A quartz-filled fissure vein occurs in the quartzite. According to Vdovic, early miners are reported to have mined a small amount of high-grade silver ore from this vein.

Barker District

The Barker district includes the area in the vicity of Barker, Hughesville, and the headwaters of the Dry Fork of Belt Creek. It is approximately 10 miles northeast of Neihart and about 9 miles east of Monarch (fig. 1). All of the Barker district at one time was within Cascade County. With the formation of Judith Basin County in 1920, most of the mines and mineral deposits in the district came under its jurisdiction. The common boundary line between the two counties now cuts through the western part of the district, leaving a few mines and mining claims in Cascade County. The underground workings of several mines now in Judith Basin County extend into Cascade County. The mines and mineral deposits in Judith Basin County will be described in a separate report on that county. Only those mines on the Cascade County side of the district will be described here. On the Cascade County side, two properties have been worked rather extensively but intermittently; several others have been worked on a small scale by lessees. Little systematic development has resulted.

Fairplay and Bon Ton (Pb-Zn-Ag)

The Fairplay and Bon Ton claims are on the east side of Barker Mountain about three-fourths mile west of Hughesville. The claims were located in the 1880's. They were operated intermittently by their owners and lessees until about 1892. Not much was done, however, until 1942, when the claims were leased by the Thorson brothers of Monarch, Mont. From 1944 to 1946 they were operated by Andrew Fineide and Ray Cecil of Monarch, Mont. Since then the properties have been idle. The Fairplay claim is owned by Mrs. Minnie Browning, et al, of Belt, Mont. Cascade County records show the city and county of Denver, Colo., to be the owner of the Bon Ton claim.

The ore occurs in replacements along the contact of thin-bedded Madison limestone and granite porphyry (29). The deposits average about 3 feet in width. The contact strikes N. 3° W. and dips 70° NE.

The Fairply claim has been opened by an 800-foot adit, which follows the contact for about 300 feet. An ore shoot about 60 feet long was developed at a depth of about 140 feet below the surface. According to George N. Bennett, the ore in this shoot had been mined above the adit level before February 1945. At that time, a winze being sunk from the adit level had reached a depth of 50 feet. The extent of the development on the Bon Ton claim could not be learned.

The ore minerals are mainly galena and sphalerite with pyrite and a small amount of chalcopyrite. Calcite and quartz are the principal gangue minerals.

Production records prior to 1942 are not available. The sorted ore produced between 1942 and 1946 was shipped to the U. S. Smelting, Refining, & Mining Co. smelter at Midvale, Utah. This production is reported to have amounted to 1,956 tons, from which were recovered 7.00 ounces gold, 8,793 ounces silver, 1,863 pounds copper, 289,600 pounds lead, and 749,400 pounds zinc (14).

The adit on the Fairplay claim was accessible in September 1949.

Silver-Bell (Ag-Pb-Zn)

The Silver, Southern Bell, and Bell claims are a short distance west and north of the townsite of Barker, formerly known as Clendennin. The Silver and Southern Bell claims are in Cascade County. Most of the Bell claim is in Judith Basin County. According to MacKnight (13), the Silver and Bell claims were located October 13, 1880, by H. C. Foster.

The claims were operated quite extensively for several years. During 1883, 2,500 tons of ore was produced and smelted in the Clendennin smelter. This ore is reported to have been mined from the upper workings in the Silver claim; it averaged 21 ounces in silver and 50 percent lead. About 420 tons of ore was mined from the lower workings, but this ore was not shipped until after the railroad was built to Barker in 1891. Some of this ore is reported to have contained 200 ounces silver a ton. From 1884 to 1890 the mine was closed (11). In 1892 the mine was operated by J. T. Armington, E. D. Barker, & Co. (9). According to MacKnight (13), the production in 1892 from the lower workings amounted to more than 20 carloads of ore; 8 carloads were produced from the upper workings.

After Armington, Barker, & Co. stopped operations, nothing further was done until 1928 or 1929, when the mine was leased by Paul Vdovic, et al. According to Vdovic, 58 tons of ore was shipped during 1929; this ore averaged 42 ounces in silver a ton and 42 percent lead. The property has been idle since 1929. The Silver and Southern Bell claims are owned by Mrs. Minerva L. Davis, Great Falls, Mont. The Bell claim is owned by the Armada Co., c/o George Huston, Great Falls, Mont.

Development on the Silver claim consists of several upper adits and open cuts and a lower adit driven westward from near the Dry Fork of Belt Creek. An 80-foot shaft was sunk the portal of the lower adit in 1892. On the 80-foot shaft level, a crosscut was driven north about 60 feet, where a vein 6 feet wide containing banded lead and zinc sulfides was intersected. When the mine was leased in 1928-29, a drift was driven westward along this vein for about 40 feet. A crosscut was driven southward through a hard, black, brecciated rock for about 50 feet. This rock contained scattered crystals of lead and zinc sulfides. A heavy flow of water from the northwest corner of the shaft prevented further exploration.

According to Weed, the ore occurs at the contact between the limy shale of the Barker formation and an intrusive sheet of porphyry (27). According to MacKnight, the ore mined from the upper workings contained mainly lead carbonate interbedded with the limestone (13). Sorted material found on the shaft dump contains lead and zinc sulfides. A Bureau of Mines sample of this material assayed 0.005 ounce gold, 3.2 ounces silver, 5.8 percent lead, 8.0 percent zinc, 0.05 percent copper, less than 0.10 percent cadmium, and less than 0.01 percent nickel.

When visisted in 1949, all of the upper adits and the open-cuts were caved and inaccessible. The lower adit was accessible for a short distance but was in very poor condition. The shaft was full of water to within about 20 feet of the collar.

Carbonate (Logging Creek) District

The Carbonate district (unorganized), also known as the Logging Creek district, is near the head of Logging Creek, about 14 miles northwest of Neihart. It covers an area of approximately 10 square miles. Most of the mining claims are arranged in contiguous groups on the north slope of the Little Belt Mountains, about 1 mile northwest of Mount Pilgrim; several of these claims extend across the divide into Meagher County. A few claims lie to the north, east, and south at distances of one-half to several miles from the main groups.

Most of the claims are at altitudes greater than 7,000 feet. The district of one-half to several miles from the main groups.

Most of the claims are at altitudes greater than 7,000 feet. The district is accessible by Forest Service roads and trails during the summer and early fall. Deep snow covers the area during the long winters. Although the roads and trails are used infrequently, they are passable to trucks and some automobiles during dry weather. The mountain slopes near the crest of the divide are rounded. Erosion has cut deep, steep-walled canyons on both sides of the divide. The north slopes generally are heavily forested with spruce, fir, and lodgepole pine. Only a small short-seasonal supply of water is available for mining and milling at the properties, but at lower altitudes some springs provide a year-round flow.

Many claims were located and patented during the 1880's or 1890's. Numerous other claims were located but later abandoned. No deep or extensive developing has been done. Most of the old shaft, adits, and open cuts are caved or otherwise inaccessible.

The ore deposits occur in the metamorphosed zones of sedimentary rocks at or near contact with igneous rocks or in fractures in limestone some distance from the intrusive rocks. Virtually all of these deposits are small and, because of their isolated location, have not been profitable to mine.

Nilson (Ag-Pb-Au)

The Nilson group of 21 patented claims is in secs. 31, 32, and 33, T. 15 N., R. 6 E., and secs. 5 and 6, T. 14 N., R. 6 E. The claims are owned by G. W. Nilson, Great Falls, Mont. Some of the claims were purchased from Cascade County at tax sale in 1940 or 1941. The rest were purchased from C. W. Hay, the original owner.

According to Nilson, two short adits have been driven along the contact of an igneous rock and limestone. Both of these adits were reported to be inaccessible. No ore has been shipped from any of the claims.

Gavander (Ag-Pb-Au)

The Gavander property, consisting of three patented claims - the Admiral Dewey, the Overlooked, and the Gold Bug - is west of the Nilson group. It is owned by J. A. Gavander, Great Falls, Mont. The contact of a quartz porphyry with thin-bedded, steeply dipping, shaly limestone has been prospected by many shallow pits and short adits. Dumps at several of the old pits indicate they were sunk mainly in an altered iron-stained porphyry. A small amount of cerussite and galena was found on one of the dumps. No work has been done for several years. No production records are available. According to Mrs. J. A. Gavander, a small amount of ore was shipped from one of the claims many years ago. When visited in 1949, the pits and open cuts had sloughed and the adits were closed by caving.

Copes (Ag-Pb-Zn)

The Copes property, consisting of four unpatented claims - the Ajax No. 1 and No. 2 and the Leadville No. 1 and No. 2 - is about 1 mile southeast from the Nilson group. Two of the southernmost claims are in Meagher County. The claims were located in the 1880's by Copes, Sr., and were worked intermittently for many years. In recent years they were worked on a small scale by the Copes brothers. V. E. Copes of Neihart, Mont., is the present owner.

Development consists of numerous shallow shafts, open cuts, and short adits. The principal workings are on a narrow ridge extending south from the divide, where a quartz vein crosses flat-lying beds of thick-bedded blue limestone. This vein strikes N. 56 W.; its dip is vertical. As exposed along the outcrop, it is lens-shaped, about 24 inches in maximum width, and within a length of about 20 feet tapers at both ends to a knife edge. A 20-foot shaft was sunk a short distance southeast of the outcropping lens but encountered only a few narrow flat-lying seams of quartz and calcite. An adit was driven southeasterly from the northwest side of the ridge about 75 feet below this outcrop. Dump material at this adit contains a small amount of galena and cerussite. V. E. Copes reports 4 tons of high-grade lead ore was shipped from the open-cut in the outcrop. A Bureau of Mines sample selected from ore specimens found on the dump at the open-cut assayed 0.005 ounce gold, 3.6 ounces silver, 19.8 percent lead, and 6.9 percent zinc.

When visited in 1949, the shaft, cribbed with 10-inch round timbers, was in good condition. The open cut in the outcrop was partly filled with debris. The adit was caved.

Other Mining Claims

Numerous other mining claims were located in the district years ago. Many of those claims were patented. The little information available regarding these claims is given in the following:

The Excelsior and Gone By claims (Ag-Pb) are south of the Gavander group. Some of these claims extend across the divide into Meagher County. Steve Pozdar, Great Falls, Mont., is the owner.

The Parnell and Board of Trade claims (Ag-Pb) adjoin the Excelsior and Gone By claims on the east. Most of these claims are in Meagher County. They are owned by Michael F. Jacobs, Kalispell, Mont.

The Even Exchange claim (Ag-Pb) is north of the Parnell and Board of Trade claims and west of the Nilson group. It is owned by Anton and Millie Seidl, Great Falls, Mont.

The Palmetto No. 2 claim is about 1-1/2 miles east of the Nilson group in the SW1/4 sec. 34, T. 15 N., R. 6 E. It was located June 7, 1889, by John W. Allen, et al. The Combination Gold Mining Co., c/o W. B. Carroll, Great Falls, Mont., is the present owner.

The Interocean claim is about three-fourths mile north of the Palmetto No. 2 claim in the NW1/4 sec. 34, T. 15 N., R. 6 E. It was located March 25, 1889, by Frank Marion, et al. Aaron R. Shull of Lewistown, Mont., is the present owner.

About 1937 or 1938 a small stamp mill was constructed by a man named Arbogast to mill gold ore from a claim northwest of the Gavander claims. According to G. W. Nilson, Great Falls, Mont., the mill was operated for a short time only and then dismantled. Nothing further was learned about the claim or its operation.

Thunder Mountain District

The Thunder Mountain district embraces an area on the north slopes of Thunder Mountain about 3 miles southwest of Monarch and about 4 miles northeast of the Carbonate district. The district's principal mining interest is its iron-ore deposits.

Thunder Mountain, the principal topographic feature, attains a maximum altitude of 8,000 feet. The main mass of this isolated mountain is a laccolith of granite porphyry, which intruded an area of limestones and micaceous shales. Erosion has removed the upper beds of the sedimentary rocks, exposing the core of the mountain and encircling sedimentary formations. Deposits of iron minerals occur along the contact of the granite porphyry and the sedimentary rocks on the northern slopes of Thunder Mountain. According to Weed (29), the sedimentary rocks locally have been baked and metamorphosed by the igneous intrustion; the soft micaceous shales were changed to hard, flinty, brittle hornstone. The iron ore is in part a replacement of the sedimentary rocks; it occurs between them and the prophyry. The deposits are lens-shaped. They occur at irregular intervals over a distance of about 3 miles. According to Goodspeed (6), the iron minerals are mainly limonite, hematite, and magnetite; bands of these minerals up to 2 feet in thickness are interbedded with numerous thin layers of shale.

Eleven mining claims have been located end to end and along the contact of the igneous and sedimentary rocks. These claims, in two groups under separate ownership, contain all of the known iron deposits in the district. They are accessible only by a rough trail that leads to the claims from Monarch.

Albright (Fe)

The Albright holdings include the Albright, Last Chance, and Valley View claims on the western end of the grouping and the Mayflower, Roosevelt No. 2, Big Horn, Humbolt, and Iron King claims on the northeastern end. The claims were located in 1901 by Villa C. Albright. They were prospected extensively during the early days but have remained idle for many years. Mrs. Alice Shadoan, Livingston, Mont., is the present owner. No ore has been shipped.

The ore bodies, consisting mainly of limonite, hematite and magnetite, occur along the contact of granite porphyry and thin-bedded limestone and shale. On the first three claims at the west, the strike of the contact ranges from N. 68° E. to N. 85° E. The dip averages about 70° NW. On the four eastern claims the stike ranges from N. 73° W. to about N. 42° W. with the dip about 70° NE. One lens-shaped deposit exposed on the Valley View claim is reported by O. C. Mortson of Great Falls, Mont., to be 20 feet wide. A lens of about the same width occurs on the Humbolt claim. A lens on the Roosevelt No. 2 claim is reported to have a maximum width of 46 feet.

The deposits have been prospected by many pits, open cuts, and shallow shafts. An adit cuts one of the lenses about 125 feet below the outcrop.

According to C. W. Brazee of Monarch, Mont., who had a lease on the claims in 1942, the ore exposed in the adit is similar to that exposed in the surface workings.

According to Weed (27), analyses made for Albright showed the ore to contain 76.9 percent Fe_2O, 0.07 percent FeO, 0.03 percent MnO, 8.80 percent SiO , 0.74 percent Al_2O_3, 0.03 percent S, and 13.36 percent H_2O - total 99.93 percent. According to W. H. Albright of Helena, Mont., an analysis of a sample of ore made by the Western Steel Co., Chicago, Ill., showed it to contain 67.21 percent iron, a trace of phosphorus, and a trace of manganese.

The claims are at altitudes above 6,000 feet. A road formerly connected the properties with the railroad at Monarch, a distance of 3 to 4 miles. In recent years the railroad was removed. The old road now is impassable for cars or trucks. The deposits are accessible only by foot or on horseback. The old workings now are caved or otherwise inaccessible.

Hurricane and Tornado (Fe)

The Hurricane, Tornado, and Edna claims are about centrally located in respect to the 11 patented contiguous claims along the north slope of Thunder Mountain. The claims were located in 1887 and 1888 by Ethelbert J. Sanford, et al. They were known at one time as the Frank Marion group. Aaron R. Shull of Lewistown, Mont., is the present owner.

The iron deposits are similar in occurrence and character to those on the Albright claims adjoining at the east and west. They occur along the contact of a fine-textured granite porphyry and thin-bedded limestone and shale. The strike is about East, the dip about 72° N. The deposits are lens-shaped, ranging in width to a maximum of about 20 feet. A Bureau of Mines sample, taken in 1943 from an open-cut on the Tornado claim where the deposit was 18 feet wide, assayed 46.32 percent iron. Analyses of five samples taken in 1936 by C. W. Brazee of Monarch, Mont., averaged 52.9 percent iron. These samples also contained a small amount of copper, about 1 percent lead, and about 2 ounces silver a ton. According to Weed (27), the deposits were reported to contain $1.50 to $3.00 gold a ton.

Other Iron Deposits

J. F. Kemp in his book "The Ore Deposits of the United States" states: "An extensive bed of very excellent carbonate ore has been discovered with coal near Great Falls in the Sand Coulee region of Montana. Being near coal, limestone, and other iron ores, it promises to be of considerable importance." No further information regarding the deposit is available.

Gold Placers

A small amount of placer gold has been recovered from several gulches in the Neihart, Barker, and Logging Creek areas. Most of those gold placer deposits were worked many years ago on a small scale. They proved to be low grade and soon were abandoned. Small-scale manual operations have been conducted on Hoover Creek about 6 miles north of Neihart, on upper Pilgrim Creek north of the Carbonate district, on Snow Creek above its junction with Carpenter Creek, and on the Dry Fork of Belt Creek below the town of Barker.

Some small-scale operations were undertaken on the Missouri River about 5 miles southwest of the town of Cascade. The placer gold in this locality was extremely fine and difficult to recover.

The total production of placer gold in Cascade County from 1904 to 1948, inclusive, is reported to have been only 11.56 ounces valued at $239 (12).

NONMETALLIC MINERAL DEPOSITS

Nonmetallic (industrial) minerals have not been mined to any great extent in Cascade County, mainly because of the limitations of local markets. Limestone has been mined for smelter and sugar plant use. Gypsum was mined and processed some 35 years ago. Fire clay is being mined for use in the smelter at Great Falls. A hard, dense sandstone has been used in the construction of some local buildings. Deposits of bentonitic clay are found in a number of areas, but none of this clay has been utilized except by a few local farmers for lining irrigation ditches. A dike containing fine mica is reported near the town of Milligan. Kootenai shale and clay are mined and manufactured into brick near Great Falls. Sand and gravel are produced at a number of localities for highway and construction purposes.

Limestone

Limestone formerly was mined at a quarry in Belt Creek Canyon in sec. 22, T. 16 N., R. 6 E., about 9 miles by road northwest of Monarch. For many years this limestone was shipped to Great Falls for use in the smelters and to Chinook for use in a sugar factory. The quarry is owned by the Anaconda Copper Mining Co. It was operated at one time under lease by Matt Antonich of Monarch, Mont. No limestone has been mined since the branch line of the Great Northern Railroad from Armington to Neihart was removed in 1945.

According to Weed (27), the limestone occurs in the Madison formation. The thinly bedded limestones about midway in the series were quarried for quicklime production and for use as smelter flux. Analyses show it to be a very satisfactory rock for these purposes.

Weed also states that limestone nodules occurring in the clay beds above the coal seam near Belt were used locally for making quicklime.

Fire Clay

Fire clay, used mainly at the copper- and zinc-refining plants of the Anaconda Copper Mining Co. in Great Falls, is mined intermittently in sec. 31, T. 19 N., R. 7 E., about half a mile northeast of Armington. The clay occurs as a shale in a bed about 5 feet thick; it is interbedded with flat-lying, reddish sandstone of late Cretaceous age. This bed is about 150 feet above the coal seam that was mined extensively some years ago.

The deposit is owned by the Anaconda Copper Mining Co.; it is worked at intervals by J. O. Randall of Armington, Mont. The shale is mined underground. Room and pillar mining methods are used, the rooms being turned off from a main haulage adit that has been driven N. 25°W. into the bed for several hundred feet. The shale in place is dry and compact. It is ground in a pug mill and tempered before it can be used as a fire clay.

Gypsum

Gypsum was mined and processed in Cascade County from 1908 to 1915. The gypsum was mined from a deposit in secs. 13 and 24, T. 17 N., R. 6 E., about 1 mile east of Riceville. Riceville, on the now abandoned Neihart branch of the Great Northern Railway, is about 9 miles south of Armington. The deposit is on land owned by Wm. Gerhart. It formerly was owned by H. L. Robinson, who transferred the mineral rights and a right-of-way to Jones H. Hall by a deed dated August 30, 1909. The present owner of the mineral rights was not learned.

According to Perry (15), the first operations were conducted by the Mackey Plaster Co. This company was succeeded by the United States Gypsum Co. Adits were driven into the steep slope of the hills about 700 feet above Belt Creek. Room and pillar methods of mining were employed. The gypsum was hauled by wagon to Riceville, where it was shipped to a processing plant in Great Falls. The crude gypsum, after being crushed, was calcined into plaster, Markets for the plaster were mainly local but some plaster was shipped as far as Seattle, Wash. About 100,000 tons of gypsum is reported to have been shipped to Great Falls. Because of difficulties encountered in obtaining leases on lands other than the 40 acres then being mined, the United States Gypsum Co. transferred its operations to Heath, Mont. Much difficulty was experienced in mining the deposit because of its irregularity. Although it was 15 feet thick and without partings at one place in the mine, it pinched out in about 100 feet. Throughout most of the mine the bed averaged 4 to 6 feet in thickness. It had a general northwest dip of about 5°.

The gypsum in this area occurs interbedded with gray-green shale and sandstone near the top of the Otter formation of upper Mississippian age. All workings were caved and inaccessible when the properties were visited by Bureau of Mines engineers in June 1948.

Another gypsum deposit occurs on the Goodman ranch in sec. 1, T. 17 N., R. 6 E., about 3 miles north of Riceville. A processing plant was built on Belt Creek about 1 mile north of the Goodman ranch by the Aluminum Plaster Co. in 1900 (15). The deposit is on land now owned by Sidney Goodman, Armington, Mont. It was prospected by an adit driven eastward into the side hill for a distance of several hundred feet. Only lenticular masses and thin seams of gypsum were encountered. Two adits, 500 and 615 feet long, also were driven into the side of the bluff on the west side of Belt Creek. No commercial bodies of gypsum were developed by either of these adits. The processing plant was operated for a short time only on gypsum hauled by wagon from other properties east of Riceville (15). When visited in 1949, all of the adits had caved and were inaccessible.

Bentonite

Bentonitic clay occurs abundantly in Cascade County, particularly in the vicinity of the town of Vaughn about 12 miles northwest of Great Falls.

Outcrops of this material are exposed along the bank of an upper bench, which rises abruptly from the valley about 2 miles north of Vaughn. Erosion also has exposed the bentonite at many places in the bottom and sides of a small valley that extends into the bench about 4 miles northwest of Vaughn. Most of the small valley is included within the boundaries of the Famous and other mining claims. These claims embrace an area of 520 acres in secs. 2 and 3, T. 21 N., R. 1 E. and secs. 34 and 35, T. 22 N., R. 1 E. They are held by location by Carl Lemmer, et al, of Great Falls, Mont.

The bentonite is interbedded with loosely compacted, shaly sandstone. Where exposed along the sides of the main highway, the bed averages about 4 to 5 feet in thickness. Farther west in the small valley the bed is more irregular and contains lenses up to 15 feet in thickness. The clay is not uniform in composition; it generally is of poor quality and contains considerable free sand and small lenses of shale. However, some of the clay appears to be a good quality of bentonite. Samples of some of the hard, shaly, unweathered material when immersed in water produces a gelatinous mass comparable with that produced by samples of some of the best quality South Dakota bentonite.

The deposits have not been developed for exploitation. Small amounts of the bentonite have been used by local farmers or ranchers for lining irrigation ditches. The claims, located by Lemmer, et al, are within a short distance of the branch of the Great Northern Railroad from Vaughn to Shelby. U. S. Highway 89 crosses the claims.

Building Stone

Hard, dense sandstone, which can be shaped readily for building purposes, occurs near Belt and Armington. It has been used in the construction of some buildings in these towns. This sandstone lies above the coal strata near the top of the Cascade formation. It occurs in layers 1 to 6 feet thick. In many places it is covered by only a small amount of overburden.

The buff-colored limestone along Belt Creek Canyon might be useful as a construction material.

Some of the massive granite porphyry in the vicinity of Neihart might be used as a building stone. It ranges in color from gray to pink. It is strong and tough; some of it will take a high polish. Its use as a substitute for eastern granite in monuments has been considered.

Mica

A mica deposit is reported to have been prospected many years ago on the west side of the Little Belt Mountains east of Milligan. According to Tom Short, White Sulphur Springs, Mont., a large amount of small-flaked mica occurs in a dark-colored dike.

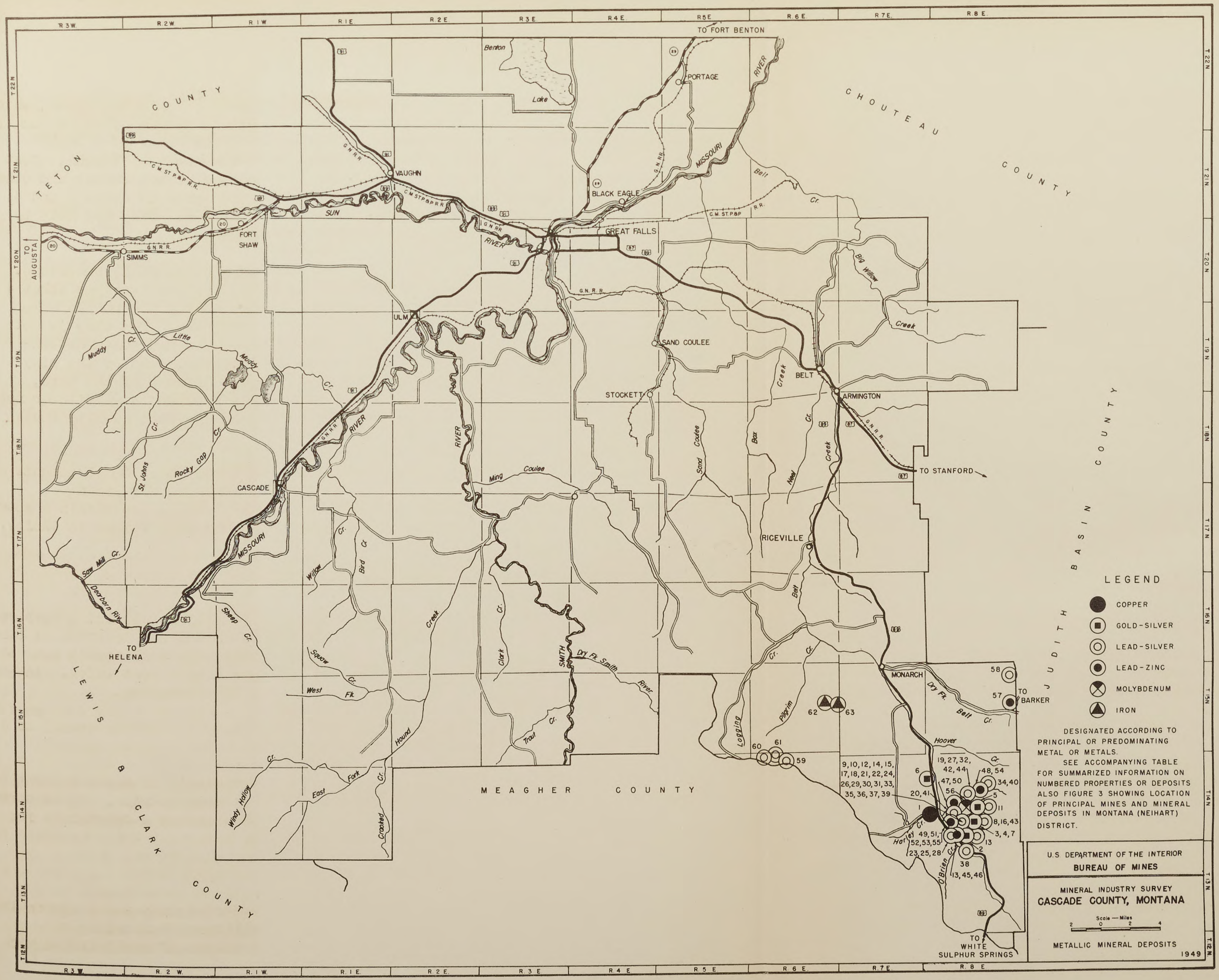


Figure 11. - Mineral industry survey map, Cascade County, Mont., showing location of metallic mineral deposits by symbols and reference numbers.

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MINERAL INDUSTRY SURVEY TABLE
CASCADE COUNTY, MONT., 1949
Metallic Mineral Deposits 1/

Map ref. no.	Name of property or deposit a/	Location Sec.	Twp.	R.	Description of deposit	Indicated metal content	Reported production	Remarks
					● - Copper			
	Montana (Neihart) district							
1	Harley Creek (Imperial, Royal, & Granite Mt. groups)	19,30	14N	8E	Veins in granite porphyry. Chalcopyrite and some gold.	To 20% Cu, a little gold.	None	450-, 200-, and 225-foot adits. Idle for many years. Workings inaccessible.
					▣ - Gold-Silver			
2	Bull of the Woods	33	14N	8E	Quartz-filled fissure in Neihart quartzite containing some sulfides, gold, and silver minerals.	?	Small amount of silver ore mined.	Shallow shaft now filled with debris.
3	Commonwealth, Spotted, & Lucky Strike	28	14N	8E	Two veins in Pinto diorite. To 2 feet in width. Local splitting. Gold and small amounts of silver sulfides, galena, chalcopyrite, and sphalerite.	Above average Au and Ag.	Some Au, Ag, Cu & Pb ore.	Two adits - inaccessible.
4	I.X.L. - Eureka	21,28	14N	8E	Disseminated shallow deposits in Snow Creek porphyry. Gold, sooty silver sulfide, some native silver, and manganese oxides. Some galena.	Above average Au, 10 to 15 oz. Ag.	1906-32 - 1,188 tons ore.	250-foot shaft - 2 levels - inaccessible. Intermittent operation. Idle since 1932. Had cyanide plant.
5	Lexington No. 2	22	14N	8E	Vein in gray gneiss. Heavy coarse pyrite containing some gold.	?	None	Short crosscut adit and drift - inaccessible. Referred to locally as the "iron mine."
6	LeRoy (Johannesburg)	7 12	14N 14N	8E 7E	Small quartz-filled fractures containing pyrite, limonite, gold, and a little chalcopyrite in silicified zones in hornblende gneiss.	Average about 0.20 oz. Au per ton.	None. About 800 tons oxidized ore on dumps.	500-foot shaft - several levels - inaccessible. 100-foot adit with several crosscuts - accessible. Idle for years. Report much low-grade ore
7	Spotted Horse	27	14N	8E	Vein in Pinto diorite and gneiss. A few inches to 3 feet wide. Altered country rock with narrow quartz stringer. Pyrite with gold, silver, little lead, zinc.	Selected ore to 1.02 oz. Au per ton.	Some ore reported to have been shipped.	Crosscut adit 120 feet with 200-foot drift. Partly accessible.
					◎ - Lead-Silver			
8	Benton	27	14N	8E	A number of veins ranging to 6 feet in width in Pinto diorite and gneiss. Pyrite, galena, sphalerite, silver sulfides, gold, some chalcopyrite. Many claims - see report.	Some high-grade bands.	54,713 tons ore from 1905-48, incl. Ranked among main producers of district.	Four main adits - 500 to 1,600 feet, and a 600-foot adit on Big Snowy claim. Adits also on a number of other claims. Most of the older adits inaccessible. No activity since April 1948.
9	Big Seven	27,28	14N	8E	Main vein in Pinto diorite and gneiss overlain by quartzite. A few inches to 12 feet wide, average 5 to 6 feet. Heavy sulfide bands in altered mineralized country rock. Long ore shoots. Pyrite, silver sulfides, gold, galena, sphalerite, copper minerals.	Good average grade. Some high grade in Au, Ag.	143,274 tons ore 1902-43. One of district's larger producers.	Four main adits with drifts, crosscuts, winzes, etc. - extensive. Big Seven adit open - others generally inaccessible. See also Lexington and Tom Hendricks. Idle at present.
10	Black Bird	28	14N	8E	Three veins in Pinto diorite and gneiss. Quartz-filled fissures ranging to 2 feet in width. Sooty silver sulfides, galena, sphalerite, pyrite, some gold.	Some good ore in narrow bands.	579 tons ore 1915-21. Net smelter returns to 1935 reported at $33,960.	Main crosscut adit with short drifts on three veins. All accessible excepting south drifts. Inactive since 1935.
11	Black Diamond	22	14N	8E	Several veins in gneiss and diorite. Width not known. Silver sulfides, galena, a little zinc and antimony.	Indicated low-grade average.	Some production. Operated 50-ton mill for several years following 1910.	Several adits now inaccessible. Property idle for many years.
12	Blizzard	28	14N	8E	Small vein in fractional claim between Pennsylvania claim of Lexington group and Spotted claim.	?	Some high-grade silver ore reported to have been mined.	Shallow shaft on vein - not accessible.
13	Broken Hill	33	14N	8E	Vein in gneiss. Similar in character but narrower than the Broadwater vein.	High silver	769 tons ore shipped 1906-1921 by various lessees.	Workings inaccessible.
14	Champion "B"	29	14N	8E	Two paralleling veins in Pinto diorite. One vein 8 to 10 inches wide; other to 3 feet. Quartz containing galena, sphalerite, pyrite, cerussite, gold.	23 oz. Ag, 10% Pb, 7% Zn.	123 tons ore 1919-46.	Three adits, all inaccessible.
15	Concentrate & Monarch	29	14N	8E	Vein reported to be 3-1/2 feet wide containing silver sulfides, galena, and some gold.	?	One small shipment	Claims are in Florence group. 1,500-foot adit with 60 foot winze that encountered heavy flow of water. Idle since 1892

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MINERAL INDUSTRY SURVEY TABLE
CASCADE COUNTY, MONT., 1949
Metallic Mineral Deposits 1/(contd.)

Map ref. no.	Name of property or deposit 2/	Location			Description of deposit	Indicated metal content	Reported production	Remarks
		Sec.	Twp.	R.				
					◎ - Lead-Silver (contd.)			
Montana (Neihart) district (contd.)								
16	Cornucopia	22,27	14N	8E	Vein composed of about 12 inches of rusty quartz with 2 feet of altered diorite on each side. Narrow stringers of sulfides. Gold, silver, galena, sphalerite, pyrite, and a little chalcopyrite.	Sorted ore on dump - 1.46 oz. Au, 53.5 oz. Ag, 5.7% Pb, 13.8% Zn.	Small production. Too much zinc in ore in early days.	Three adits, a 300-foot shaft with 2 levels. All inaccessible. Long idle.
17	Cumberland	29	14N	8E	Vein in gneiss. May be same vein as that on Peabody claim at north.	?	Some high-grade ore reported mined some years ago.	400-foot adit - inaccessible.
18	Dacotah	28	14N	8E	Three veins - only one developed and mined. Dacotah vein in strong fissure in gneiss - 2 to 8 feet wide but narrower in Pinto diorite. Vein mainly of altered crushed country rock with bands and disseminations of pyrite, lead, zinc, and silver sulfides.	7 to 10% combined Pb and Zn, 1 to 3 oz. Ag.	More than 1,000,000 lb. Pb, nearly 3,000,000 lb. Zn with appreciable Ag, Au, and Cu from 1942-49. Ore milled in Florence mill.	Four adits from 100 to over 1,200 feet long. Also two others on other veins mined to small extent years ago. Operation suspended May 1949.
19	Double X "XX"	16	14N	8E	Vein following well-defined fracture along a porphyry-gneiss contact. Quartz, galena, sphalerite, silver sulfides, pyrite, and some chalcopyrite.	?	Small	300- to 500-foot adit and some shallow shafts - inaccessible. Last worked about 1934.
20	Eighty Eight "88"	20	14N	8E	Vein probably in diorite and gneiss. Details lacking. Silver sulfides, galena, sphalerite, chalcopyrite, cerussite in quartz and ankerite.	?	Small tonnage mined.	Upper adit. Lower adit about 1,700 feet long mostly in rock. Inaccessible. Little done since 1890.
21	Fairplay	28	14N	8E	Narrow vein in Pinto diorite. Silver sulfides, galena, sphalerite, pyrite, cerussite, considerable limonite.	Sorted ore: 20 to 74 oz. Ag, 11% Pb, 18% Zn.	125 tons of ore, 1919-26.	Short adit - inaccessible.
22	Florence	29	14N	8E	Four well-defined veins in gneiss. Concentrated vein 3-1/2 feet wide. Florence (Main) vein 4 to 6 feet wide with splits. High-grade bands and streaks, sometimes filling full width of vein. Galena, sphalerite, pyrite, silver sulfides, some gold, copper minerals, in barite, ankerite, quartz.	15 to 25 oz. Ag, 5 to 6% Pb.	105,189 tons ore 1901 to 1943, incl. No records before 1901, but high-grade ore reported. A large producer.	Six adits. Two-compartment winze from lowest adit, 500 feet deep with 5 levels. Most of lower adit accessible. Winze and other adits inaccessible. Idle since 1943.
23	Frisco	29	14N	8E	Two narrow quartz-filled fissures in hard gneiss. Only one warranted development. Silver sulfides, galena, pyrite, and sphalerite.	Selected ore on dump - 52 oz. Ag, 33% Pb, 9.5% Zn.	No ore shipped.	625-foot adit driven in 1939 to explore what was considered to be southern extension of Equator vein. Adit accessible, raise from it has caved.
24	Galt	29	14N	8E	Four or more veins in Pinto diorite and gneiss. Main (Galt) vein only one mined. 1 to 20 feet wide. Altered crushed country rock with bands and lenses of sulfides-silver sulfides, galena, sphalerite, pyrite with barite, ankerite, and quartz.	At 950-foot depth - 20 oz. Ag, 4.5% Pb, 4.5% Zn. Some high grade.	800,000 oz. Ag up to 1920. 20,961 tons ore from 1901 to 1948, incl.	Two upper adits; lower one partly accessible. Also extension of Queen adit and of levels from Queen shaft, all now inaccessible. Some mining during 1949. First mine in Neihart district to pay dividends.
25	Graham & Hollowbush (S & R)	32	14N	8E	Vein composed mainly of silicified greiss with sulfides mainly in irregular bands but some disseminated. Silver sulfides, pyrite, galena, sphalerite, and chalcopyrite. Some gold. Thought by some people to be extension of Broadwater vein.	Sample of material on dump - 2.5% Pb, 2.5% Zn, 4.3 oz. Ag. Some high-grade spots.	No early records. 5,636 tons ore from 1934 to 1943, incl.	Adit and 250-foot shaft with 2 levels. Heavy flow of water on 250-foot level. Not mined below. All workings inaccessible.
26	Hartley	29	14N	8E	Three or more veins in gneiss. Main No. 3 vein occupies well-defined fissure - a few inches to 4 feet in width. Main ore shoot 600 feet long. Banded. Silver sulfides, native silver, galena, sphalerite, pyrite in crushed gneiss with quartz, ankerite, barite.	Some secondary enrichment. Above average silver ore.	Large early production not of record. 64,423 tons ore from 1901 to 1940, incl. 1,523,426 oz. Ag, 3,894,765 lb. Pb.	Main adit about 1,000 feet long. Winze from adit 500 feet deep. Most of main vein above bottom level mined for length of about 400 feet. All workings inaccessible.
27	Hegener	16	14N	8E	Four or more veins in gneiss, diorite, and quartz porphyry. Vilipa vein most productive - silver, lead, zinc, copper, iron sulfides and gold. Gold Rock vein minerals the same with native copper and silver. Baker vein is low-grade mineralized zone containing mainly chalcopyrite.	Some high-grade silver ore.	Some small lots. Shipments in total value reported at $25,000 to $30,000.	400-foot adit and 115-foot shaft with 300-foot drift level on Vilipa; 100-foot shaft with 50-foot drift level, and 265-foot adit drift on Gold Rock; 165-foot adit drift and 100-foot X-cut on Copper Queen; 75-foot adit on Baker. All now inaccessible.

MINERAL INDUSTRY SURVEY TABLE
CASCADE COUNTY, MONT., 1949
Metallic Mineral Deposits 1/ (contd.)

Map ref. no.	Name of property or deposit 2/	Location Sec.	Twp.	R.	Description of deposit	Indicated metal content	Reported production	Remarks
Montana (Neihart) district (contd.)					◎ - Lead-Silver (contd.)			
28	Hidden Treasure	32	14N	8E	Vein in gneiss. West of the Broadwater.	?	None of record.	Adit several hundred feet long. Inaccessible. No work for many years
29	Ingersoll	29	14N	8E	Two veins. Ingersoll (main) vein generally narrow and low grade with some higher-grade bands. May be extension of Moulton vein. Silver sulfides, galena, sphalerite, pyrite, gold.	Sorted ore: 20-40 oz. Ag, 11-40% Pb.	Six carloads sorted ore prior to 1904. 107 tons sorted ore from 1904 to 1917, incl.	Adit drift 1,100 feet with 75-foot crosscut, 112-foot raise with 150-foot drift. West crosscut from main adit 600 feet to Queen of Mts. vein with south drift to Gem (Moulton) claim. All workings now inaccessible
30	Lexington	28	14N	8E	Vein about 3 feet wide in Pinto diorite and gneiss under quartzite. Silver sulfides, galena, sphalerite, chalcopyrite.	?	Considerable silver-lead ore reported mined. Production not segregated.	Three adits on Lexington claim, 360 to nearly 1,000 feet long. Inaccessible.
31	Lizzie	29	14N	8E	Four or more veins of differing character in Pinto diorite and gneiss. 8 inches to 4-1/2 feet wide. Silver, lead, copper, iron sulfides in quartz and altered country rock. Small ore shoots.	Generally low with high-grade bands and lenses.	$5,000 to 1897. From 1907-43, incl., 347 tons of ore shipped.	Six adits on 2 veins with crosscuts. 40-foot discovery shaft. Two adits only partly accessible. Idle since 1943.
32	Minute Man (Last Hope-Westgard)	15	14N	8E	Main vein 2 to 7 feet wide in gneiss. Highly altered and kaolinized. Difficult to sort. Galena, sphalerite, chalcopyrite, pyrite, silver sulfides. Other vein of three quartz bands 12 to 24 inches wide with 6 inches of silicified gneiss between. Oxidized Fe, Pb, Zn minerals.	Generally low - difficult to sort.	No records prior to 1932. 317 tons ore from 1932 to 1944, incl.	300- and 700-foot adits, 48-foot shaft with short drift. Inaccessible Idle.
33	Nevada (Survey 2680)	29	14N	8E	Vein reported to be continuation of Galt vein.	?	Some good silver ore reported mined in early days.	250-foot shaft with several levels - now inaccessible.
34	New Alicia & New Rodwell	10	14N	8E	Vein, mainly of quartz, in altered silicified quartz porphyry. 2 to 24 inches wide. Galena, sphalerite, pyrite, chalcopyrite, silver sulfides & oxidized products.	?	None reported.	150-foot drift adit on New Alicia caved at portal.
35	Peabody	29	14N	8E	Vein in gneiss possibly northward continuity of Cumberland vein.	Low with higher-grade spots.	No record prior to 1922. 152 tons ore 1922 to 1940.	No information. All workings inaccessible.
36	Ripple	29	14N	8E	Vein on Ripple claim is midsection of same vein as the Flora and Tom Hendricks averaging 2 to 4 feet in width. Bands and disseminated silver sulfides, galena, sphalerite, pyrite and a little chalcopyrite in altered crushed gneiss and diorite.	Good grade. Richer parts mined during early days.	No record prior to 1906. 25,634 tons ore from 1906-1945. In 1946 up to April 7, 1947, 974 tons ore with reported gross value of $105,815.	Four main adits - two shorter adits. Three of these adits extend into Tom Hendricks. Upper adits inaccessible. Flora adit partly accessible. Company operations suspended April 1948.
37	Rock Creek	29	14N	8E	Several veins in Pinto diorite and gneiss. Main vein 1 to 3 feet wide. Several ore shoots mined.	-	Small early day production of 80 oz. Ag & 16 to 18% Pb ore after close sorting.	Main adit with crosscuts & drifts. Now inaccessible.
38	Ruth Mary & Fitzpatrick	4	13N	8E	Both on same vein in gneiss. Up to 3 feet wide. Sulfides mainly in bands & stringers in altered rock. Oxidized minerals also. Short irregular ore shoots. Other vein to west unproductive.	Some high silver.	Mainly before 1934 but no record. 50 tons shipped 1934 to 1937, incl.	Short upper adit. Main adit 30 feet lower follows vein for 1,300 feet. Now open only for about 100 feet.
39	Silver Belt	28	14N	8E	Vein in Pinto diorite and gneiss. May be continuity of Broadwater vein or a branch. Four or more short ore shoots mined above lowest winze workings. Some secondary enrichment.	High silver and some gold.	No record before 1900. 62,175 tons ore from 1902 to 1941, incl.	425-foot crosscut adit with drifts and 100-foot winze. Now inaccessible.
40	Silver Dyke	10	14N	8E	Mainly disseminated silver minerals, gold, chalcopyrite, galena, pyrite, a little sphalerite, oxidized products in highly altered brecciated mass of quartz porphyry, granite porphyry,& gneiss. Some in irregular stringers. 600 feet long, 400 feet wide, mined to depth of 150 feet.	Mill heads 1926-1927 averaged 4.48 oz. Ag, 1.56% Pb, 0.78% Cu.	Largest producer. 1,167,125 tons ore mined and milled, 1921 to 1948 1,736 oz. Au, 3,177,068 oz. Ag, 16,367,760 lb. Pb, 7,453,527 lb. Cu.	Main lower adit about 1,000 feet long. Raises to glory hole. Old upper adit. Underground workings now ineccessible. In 1926 mill capacity enlarged to 950 tons. Operation terminated 1929 - mill dismantled.

MINERAL INDUSTRY SURVEY TABLE
CASCADE COUNTY, MONT., 1949
Metallic Mineral Deposits 1/ (contd.)

Map ref. no.	Name of property or deposit 2/	Location			Description of deposit	Indicated metal content	Reported production	Remarks
		Sec.	Twp.	R.				
Montana (Neihart) district (contd.)								
					◎ - Lead-Silver (contd.)			
41	Star	29,30	14N	8E	Star vein follows strong sheeted fissure in gneiss & Pinto diorite. 4 to 17 feet wide but higher grade ore in bands 4 inches to 2 feet wide. Silver sulfides, galena, pyrite, sphalerite, chalcopyrite. Two parallel unproductive veins. London ore shoot 600 feet long, mined to depth of 400 feet.	Ore mined and milled in recent years was low grade.	No record prior to 1901. 54,610 tons ore from 1901 to 1948. Includes some ore from Galt & Equator claims.	Three adit drifts. Star adit 2,218 feet long with 3 winzes to shallow depths. A 140-foot crosscut to 2 veins to the west. Star adit caved at portal. Upper adit caved. Mine inactive since 1945 but mill operated
42	Sherman (Flamsberg)	15	14N	8E	Vein follows fissure in porphyry and gneiss. 2 inches to 2 feet wide. Small short lenses. Silver sulfides, galena, sphalerite, pyrite, chalcopyrite, some cerussite in ankerite and quartz gangue.	Required sorting.	Some early day production. Small recent production.	Upper 50-foot crosscut adit. Main adit 400 feet long. 35-foot shaft. All workings now inaccessible.
43	Tom Hendricks	27	14N	8E	Southern continuity of the Flora-Ripple vein, also several other minor veins in gneiss & diorite. Main vein 3 to 4-1/2 feet wide.	Above average.	Large but not segregated due to interownership and its operation by adjoining mines.	Three long main adits, all driven from other properties (See Ripple, Benton). All workings inaccessible now.
44	Whippoorwill	16	14N	8E	Vein along quartz porphyry-gneiss contact.	Generally low.	10 tons ore reported shipped in 1922. No other records.	250-foot shaft with several levels and 40-foot winze with drift. Now inaccessible.
					◉ - Lead-Zinc			
45	Broadwater	32	14N	8E	Vein in schist and gneiss. 3 to 6 feet wide. Composed mainly of mineralized altered country rock usually distinctly banded and sheeted with high-grade sulfides. Galena, sphalerite, pyrite, chalcopyrite, silver sulfides with barite, rhodochrosite, ankerite, quartz.	High grade ore shoots.	Second largest producer. Large production prior to 1940 estimated at $5,000,000. From 1940 to 1947 produced 108,214 tons of ore.	Inactive since 1947. Main workings from 3 long adits. A 125-foot winze from lowest adit with 2 levels. Levels from two old shafts entered adjoining properties. Extensive development to about 1,000 feet below surface. Now mostly inaccessible.
46	Compromise	32	14N	8E	A Moulton group claim. Moulton vein and a vein at the east only ones developed and mined on Compromise claim. In gneiss.	?	Production not segregated. Included in Moulton records.	400-foot adit now inaccessible. Main adit extends into other claims. Most of main adit workings accessible. A 150-foot shaft with drift on 120-foot level partly filled with water. Idle since 1945.
47	Cowboy	17,20	14N	8E	Vein, 1 to 3 feet wide, composed mainly of quartz, calcite, and ankerite in Pinto diorite. Contains bunches and disseminated galena, sphalerite, pyrite, & silver sulfides.	Stored sorted ore - 4.7% Pb, 9.8% Zn, low Ag & Cu.	Some shipments. None since 1946.	Old main adit drift with winze, also lower adit 75 feet long in June 1949. Adits in good condition. Winze filled with water.
48	Dawn & Foster	16	14N	8E	Quartz vein along porphyry-gneiss contact containing some bunches of galena & sphalerite.	Averages low.	No record.	Several hundred feet of adit drifts-now inaccessible.
49	Equator	29	14N	8E	Two veins in gneiss. Range to 2-1/2 feet in width. Equator vein main one but some ore mined from parallel vein 25 feet to west.	Low-grade ore milled by Star Mg. Co. in 1948-1949.	No record prior to 1915 or after 1917. Since 1944 included in Star Mining Co. records. 364 tons ore from 1915 to 1917.	Adit drift driven northerly to old Galt workings. Open and in good condition for first 1,300 feet.
50	Hatchet	20	14N	8E	Vein in diorite, gneiss, and porphyry. Narrow and irregularly mineralized.	?	None recorded. Ore reported to contain too much zinc to permit shipment.	Adit drift about 300 feet long. Caved at portal. Long idle.
51	Moulton	29	14N	8E	Several veins. Moulton vein only one mined. 3 to 7 feet wide. In mica schist & gneiss. Mainly crushed altered country rock containing disseminated sulfides with bands or lenses of higher-grade ore to 2 feet in width. Galena, sphalerite, silver sulfides, and small amounts of chalcopyrite and pyrite.		450,000 oz. Ag to 1893. Total to 1923, estimated value about $1,500,000. Most ore mined from shaft workings.	Two long adits. A 550-foot three-compartment shaft with levels at 100-foot intervals. 125-foot winze from 500 foot level to 625 level then another winze to below 700-foot level. All now inaccessible.
52	Mountain Chief	20,29	14N	8E	Three veins in gneiss & Pinto diorite. Range from 1 to 4 feet in width with local widenings. Several good ore shoots mined. Galena, sphalerite, chalcopyrite, pyrite and oxidized products.	?	Considerable, but no records available.	Four shafts, deepest 310 feet. Also three adits 700, 1,000, and 1,700 feet long. Long idle. All inaccessible.

MINERAL INDUSTRY SURVEY TABLE
CASCADE COUNTY, MONT., 1949
Metallic Mineral Deposits 1/ (contd.)

Map ref. no.	Name of property or deposit 2/	Location Sec.	Twp.	R.	Description of deposit	Indicated metal content	Reported production	Remarks
Montana (Neihart) district (contd.)					◉ - Lead-Zinc (contd.)			
53	Queen of the Hills (Queen-O'Brien)	29	14N	8E	Queen (main) vein 1 to 6 feet wide, and O'Brien vein in gneiss. Silver sulfides, galena, sphalerite, pyrite, chalcopyrite with quartz, ankerite & barite. Oxidized in upper workings.	1926-29, unsorted shipped ore averaged about 20 oz. Ag, 4.5% Pb, 11% Zn.	Large prior to 1901. 41,358 tons of ore from 1901 to 1942, incl.	Three adits, lower one enters Galt claim. 300-foot shaft with levels at 100 and 300 feet. All now inaccessible. Shaft filled with water to 75 feet of collar. Idle since 1942.
54	Savage	15	14N	8E	Vein in altered gneiss composed mainly of country rock with some disseminated sulfides with bands of heavy sulfides near walls. 3 to 5 feet wide where exposed in stope south of shaft. Several small ore shoots.	Average low grade.	Some production but not of record. Small production in 1948-49.	Adit 400 to 500 feet connecting with old 100-foot shaft. Adit open.
55	Unity and Rochester	29	14N	8E	Both of these claims are in the Moulton group. Several veins.	?	Some production but not of record.	Adit crosscut (Rochester) driven easterly from Unity claim for 540 feet with short drifts on 2 veins.
					⊗ - Molybdenum			
56	Big Ben Molybdenum	21	14N	8E	Stockwork in which molybdenite, with pyrite and small amounts of galena, chalcopyrite and fluorite occur in irregular fractures and disseminated in silicified zones of gneiss, diorite & porphyry.	0.23% MoS_2 in area 520 feet long, 270 feet wide to depth of 365 feet.	None	Two adits with short drifts & crosscuts. Accessible. Numerous surface trenches. Diamond drilled and sampled by Bureau of Mines in 1943.
Barker district					◉ - Lead-Zinc & ◎ - Lead-Silver			
57	Fairplay & Bon Ton	1	15N	8E	Replacement along limestone-granite porphyry contact. About 3 feet wide. Several ore shoots. Galena, sphalerite, pyrite and some chalcopyrite.	High-grade Pb and Zn. Low Ag.	No record prior to 1942. 1,956 tons ore from 1942 to 1946, incl.	800-foot adit with 50-foot winze on Fairplay. Accessible. No date on development of Bon Ton claim.
58	Silver Bell	13 18	15N 15N	8F 9E	Replacement along or near contact of limestone with igneous rock. Galena, sphalerite, pyrite, a little chalcopyrite with cerussite in upper workings. Reported width to 6 feet.	Some high-grade Ag ore.	Considerable during early days. 58 tons of ore. shipped in 1929 averaged 42 oz. silver, 42% Pb.	Three adits and an 80-foot shaft with short crosscut and drift. Heavy flow of water encountered in shaft. Except part of lower adit all workings inaccessible. Idle since 1929.
Carbonate (Logging Creek) district					◎ - Lead-Silver			
59	Copes	4	14N	6E	Short quartz lens 24 inches in maximum width in limestone. Galena and sphalerite with some cerussite. Other small veins.	-	4 tons of high-grade lead ore reported to have been shipped some years ago.	Numerous shallow pits, open-cuts and several short adits. A 20-foot shaft. Adits caved. Shaft open. Two of claims in Meagher County.
60	Gavander	6	14N	6E	Deposit along limestone-quartz porphyry contact. Galena and cerussite in iron-stained porphyry and limestone.	Low	Small tonnage reported shipped years ago.	Shallow pits and several short adits. Now inaccessible.
61	Nilson	31,32,33 5,6	15N 14N	6E 6E	Deposit along limestone-igneous rock contact. No details available.	-	None	Two short adits.
Thunder Mountain district					▲ - Iron			
62	Albright	13 18	15N 15N	6E 7E	Lenses to 20 feet in width along limestone-granite porphyry contact. Limonite, hematite, magnetite. Some gold. Some sulfides indicated.	52 to 54% Fe.	None	Open-cuts, shallow shafts, one adit. Claims in two groupings with Hurricane-Tornado claims between. All workings caved.
63	Hurricane-Tornado	13	15N	6E	Lenses to 20 feet in maximum width along limestone-granite porphyry contact. Minerals same as at Albright. Some gold & silver and a little copper and lead reported in analyses of some samples.	52 to 54% Fe.	None	Old shallow pits and caved adit.

1/ Classified as well as conditions permit according to principal or predominating metal or metals.
2/ Also known by names in parenthesis.